VOLUME 37
NUMBER 10

OCTOBER, 1950

plating

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FLUOBORATE NICKEL BARREL PLATING

See Contents Page 1037

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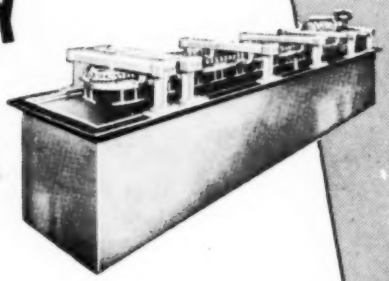
EQUIPMENT and SUPPLIES *for the* POLISHING and PLATING INDUSTRY



A request on your Company Letterhead will bring a catalog to you immediately.

FREDERICK **GUMM** *Chemical Company Inc.*

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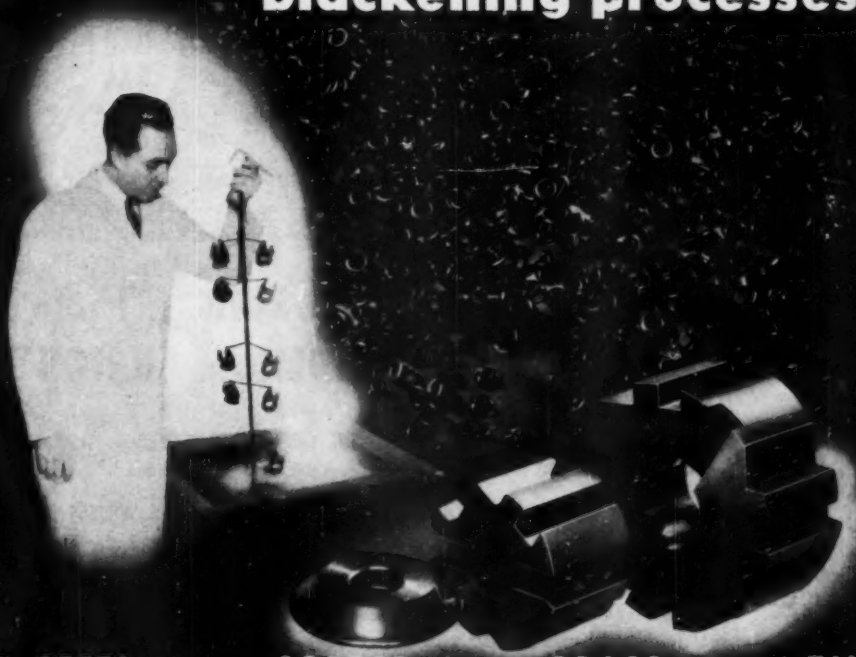
EBONOL

blackening processes



FOR STEEL . . . COPPER . . . BRASS . . . ZINC

Enthone Ebonols today give new beauty, increased wearability and better functional qualities to hundreds of metal products.

The field is widely diversified: metal screens, cameras, business machines, machine tools, buttons, nameplates, dress trimmings, compacts, automobile hardware and accessories, etc.

EBONOL-C. (U. S. Patent 2,364,993) This is the best method of blackening and coloring copper and its alloys. Durable black cupric oxide is produced in a simple solution. Any metal that can be copper plated can also take this finish.

EBONOL-S. A one-bath method of blackening steel. Temperature 285 to 290° F. Simple to use and pleasant to run.

EBONOL-Z. A simple process for blackening zinc plate and zinc base diecastings. Beautiful glossy or dull finishes are achieved at low cost and trouble-free operation.

NEW TUMBLING TECHNIQUES are available for blackening and coloring. Send samples for free finishing demonstrations together with advice of experienced research chemists. *Write for new literature with procedures.*

ENTHONE INC., 442 Elm Street, New Haven, Conn.

ENTHONE

S-T-R-E-T-C-H YOUR CADMIUM

ASK THE PLATER WHO IS USING IT! He'll Tell You That ROHCO 20XL CADMIUM BRIGHTENER:

1. GIVES UNBELIEVABLE UNIFORMITY OF DEPOSIT THICKNESS. This improvement means that LESS CADMIUM is used to meet minimum thickness specifications.
2. GIVES UNEQUALED BRILLIANCE OF DEPOSIT OVER THE WIDEST BRIGHT CURRENT DENSITY PLATING RANGE. This means freedom from burning combined with bright recesses.
3. PROVIDES MAXIMUM PRODUCTION FROM BARREL UNITS—because ROHCO 20XL Barrel Solutions may be operated at unusually high temperature (up to 105° F.) thus minimizing cooling difficulties. ROHCO 20XL Barrel Solutions provide unusually high conductivity because they may contain up to 4 oz. per gallon caustic soda, thus giving maximum current and production.
4. IS VERY EASY TO CONTROL—because it has an unusually wide latitude of operable concentration range. Conversion to ROHCO 20XL does not require extra treatment or entail delay in production.
5. IS ECONOMICAL TO USE—for the reason that it costs 2% or less of the metal used. This cost, many times, is less than the cadmium and labor saved through improved throwing power, higher production and reduced rejects
6. IS AVAILABLE IN EITHER POWDER OR LIQUID FORM, AS DESIRED.

ROHCO

ROHCO PRODUCTS
NO-CRO-MIST • HULL CELL TEST • ROHCO 20XL CADMIUM BRIGHTENER ROHCO 100 BARREL AND STILL ZINC BRIGHTENERS • RINS-AID • CROMETER

"YOUR PLATING IS BEST WITH THE HULLCELL TEST"

R. O. HULL & C

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BUT... *IF YOU MUST SUBSTITUTE ZINC FOR CADMIUM*

USE ROHCO 100 BARREL and ROHCO 100 STILL BRIGHTENER

FOR ZINC!

ROHCO 100 BARREL and STILL BRIGHTENERS are concentrated liquid brighteners, easily diluted with water for daily or single load barrel additions. The BARREL BRIGHTENER produces brilliant deposits directly from the bath at a lower cost. Both have the ability to plate many types of ferrous metals which usually do not readily plate with zinc.

An Improved barrel zinc bath formulation minimizes brightener consumption; promotes rapid deposition without re-solution of the plated zinc; reduces chemical attack of zinc anodes and makes proper solution maintenance easier.

LOWEST COST

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HIGHEST PRODUCTION

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SIMPLEST CONTROL

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Gentlemen:

SEND
- ....Lbs. Powder, ROHCO 20XL CADMIUM BRIGHTENER
- ....Gallons Liquid, ROHCO 20XL CADMIUM BRIGHTENER
- ....Gallons, ROHCO 100 BARREL ZINC BRIGHTENER
- ....Gallons, ROHCO 100 STILL ZINC BRIGHTENER

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Company .....

Street Address .....

City ..... Zone ..... State .....

Plating anodes should—must—go into solution uniformly, if an economical, high quality deposit is to be obtained.

That ANACONDA Anodes do so is graphically demonstrated by this photograph. It shows ANACONDA Copper Anodes new and after 24, 36, 48 and 50 hours. Note the smooth surfaces.

Furthermore, ANACONDA Anodes reduce slime to a minimum and scrap losses are exceptionally low.

ANACONDA Anodes are supplied in copper, brass and bronze—rolled sheet or oval; in standard sizes or to your specifications; with or without hooks. Also copper "cathode-anodes." Publication C-5 will tell you more. Write for it to The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

For plating with Copper, Brass or Bronze

USE ANACONDA® ANODES

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 993.

Industry News

Darco Corporation, formerly a subsidiary of Atlas Powder Company, became the **Darco Department** of that Company in a merger effective July 31, 1950.

Product, personnel and distribution will be continued. Darco plant expansion at Marshall, Texas, previously announced, is being pushed to the earliest possible completion. With this added capacity and backed by Atlas Powder Company's resources and extensive research, development and engineering facilities, Darco is set to maintain its position as a leading manufacturer of activated carbons.

Schaffner Manufacturing Company, Inc., Schaffner Building, Pittsburgh 2, Pa., manufacturers of polishing and buffing compositions, has just completed a new expansion in plant facilities, warehousing space, and production equipment, which will enable it to increase production approximately 75 per cent.

As of September 1 the Company is adding a Platers' Supply Division. Manufacturers seeking representation or warehousing facilities in the Tri-State area of Western Pennsylvania, West Virginia and eastern Ohio are solicited.

Electrochemical Society Buffalo Convention. Seventy papers, covering the subjects, Batteries, Corrosion, Electrodeposition, and Electro-organic Chemistry, will be presented at the 98th meeting of the Society in Hotel Statler, N. Y., October 11–13.

Papers on corrosion will be given during three sessions: Wednesday morning and afternoon, October 11, and Thursday morning, October 12. Papers on electrodeposition will be presented all day Thursday, October 12, and all day Friday, October 13.

An additional feature will be the award of the Acheson Medal and Prize to Dr. George W. Vinal of the National Bureau of Standards, Washington, D. C. The gold medal and $1,000 prize will be presented to Dr. Vinal at a banquet in his honor, to be held Thursday evening, October 12.

Plant trips of interest are scheduled to Gould National Battery Company; Westinghouse Electric Corporation motor assembly plant; E. I. duPont de Nemours viscose plants producing rayon, cellophane, and sponge; Lionite Abrasives, Ltd., new silicon carbide plant; Buffalo Electro-Chemical Company installation of

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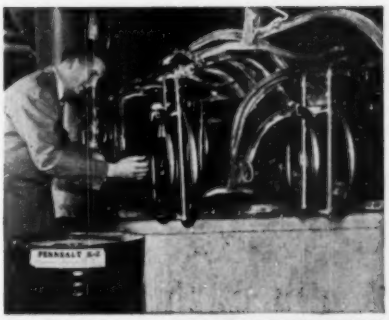
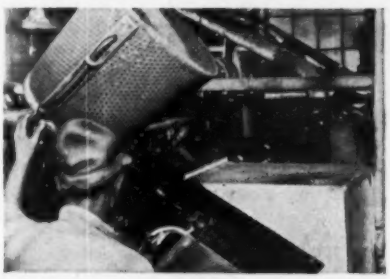
At Maytag
quality control counts
...and PENNSALT CLEANERS fill the bill

1 Pennsalt Cleaner being used in a Stevens Automatic Conveyor machine at the Maytag Plant. Pennsalt K-2 Cleaner is used in proportions of 8 oz. to a gal. of water at 212° F. for a 2-minute electroclean.



2 Along with the conveyor-type cleaning machine, Maytag uses this Stevens Automatic Barrel machine for cleaning small parts. Same solution of Pennsalt Cleaner is used as on conveyor cleaner.



3 The Washer that goes to the cleaners first! The Maytag Automatic Washer is a favorite among home-makers throughout the country for its smart appearance and long life. Pennsalt Cleaners are also used for cleaning the sheet steel prior to porcelain enameling for outside parts.

In the Maytag Company's Newton, Iowa, manufacturing plant, Pennsalt Cleaners take on the tough job of removing cutting lubricants, drawing and stamping compounds, carbon smut, and shop dirt from washing machine parts prior to zinc plating. In *just two minutes*, Pennsalt Cleaners remove this soil; get steel parts clean and ready for subsequent finishing steps. This is quick, efficient, *economical* cleaning—the kind you can count on with Pennsalt Cleaners in your plant!

There are efficient Pennsalt Cleaners for every metal-finishing operation—a special cleaner to meet every problem. ***And all Pennsalt Cleaners have these advantages in common:***

They are concentrated cleaners—most of them anhydrous. You can use a minimum of cleaning compound; you don't pay for excess water.

They have long life—frequent dumping of large process tanks is unnecessary. Furthermore, most Pennsalt Cleaners are made from *fused* materials—you get a uniform solution every time you make up a new charge.

They are free rinsing in either hot or cold water. You get cleaner metal, less drag-out, less contamination of subsequent steps.

Get the complete story on Pennsalt Cleaners and how they can save time and money in your plant. The Pennsalt Representative in your locality will be glad to study your present cleaning method and make recommendations without obligation. Or, write: Special Chemicals Department, Pennsylvania Salt Manufacturing Company, Philadelphia 7, Pa.

There's a Pennsalt Cleaner
for every
metal cleaning operation

PENN SALT

PROGRESSIVE CHEMISTRY FOR A CENTURY

Industry News

the contact rectifier; Colonial Radio Corporation electronic equipment plant; and Huntley Station steam electric-generating plant.

Additional information may be obtained from Dr. Henry B. Linford, Secretary of The Electrochemical Society, 235 W. 102nd Street, New York 25, N. Y.

American Society for Testing Materials has authorized the formation of a technical committee on Sampling and Analysis of Atmospheric Pollution. Dr. Louis C. McCabe, Chief of Air and Stream Pollution, U. S. Bureau of Mines, and an outstanding authority in this field, has accepted temporary chairmanship of the new committee.

The Society will not consider the problems of specifying limitation of pollution, nor such other related matters as biological and health problems.

Much research is already directed toward the development of instruments by which a single or a few contaminants can be measured. Studies are continuing in various channels on contaminants to be measured, which will offer a true index of the nature and extent of pollution in an atmosphere. The smog situation in leading industrial centers, coupled with incidents such as the deaths at Donora, attributed to air pollution, is responsible for the present concerted interest in abatement.

Dry Lubrication Processes. Processes that produce a solid film or "dry" lubricant, impregnated into the surfaces of metals, plastics, rubber and ceramics to reduce friction and wear, are now offered by the Metal Finishing Division of the Pyrene Manufacturing Company, Newark, N. J. It is claimed that the highly desirable characteristics of graphite are retained, throughout wide ranges in temperature, in a permanent film that is unaffected by exposure to solvents or weather.

These processes have already proved in regular production their value in reducing wear in internal-combustion engines and other moving parts: disc clutches, brakes, gears, worms, and splines. The electrical and aviation industries are employing them to reduce erosion and inhibit corrosion.

Electrofilm Graphite Processes, as they are known, were invented by the Electrofilm Corporation of California. Along the Eastern seaboard from Maine to Virginia they will be supervised through Pyrene's Metal Finishing Division. They will be available either on job work handled in the Pyrene plant or, if volume warrants, on a licensing basis with Pyrene technical advisory counsel.

in BURNISHING MATERIALS
it's the SHAPE that counts!
For better burnishing of flat surfaces joined to curved or cylindrical sections . . . use Abbott Burnishing Cones. They're shaped to do the job right!
Abbott Burnishing Materials, available in five shapes — Ball, Ovalball, Cone, Diagonal, Pin — are scientifically designed to make effective contact on metal stampings or castings of any size and shape. Each piece is a burnishing tool made from Abbott's high quality bearing ball steel. Each is deep hardened and polished to a mirrorlike, glass-hard finish. For consistently better burnishing results . . . use Abbott!
Some parts require a special mixture of Abbott Burnishing Materials. Send for catalog showing sizes, shapes, uses. No obligation.
THE ABBOTT BALL COMPANY
1054 New Britain Ave.,
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ABBOTT

Tetrafluoroethylene Resin. A new unit of the duPont Company's plastics plant near Parkersburg, W. Va., has gone into commercial production of "Teflon" tetrafluoroethylene resin, an industrial plastic highly resistant to chemicals and heat and one of the best insulating materials known. The productive capacity is several times that of a plant at Arlington, N. J., where manufacture of the plastic in relatively small commercial quantities was started in 1943.

For the next few months the unit will produce granular "Teflon" only. Further expansion, however, is under way for the manufacture of the new "Teflon" suspensoid, a suspension of minute particles of the plastic in a liquid, from which corrosion-resistant finishes have been developed.

Correspondence Course in Electroplating. The Joseph B. Kushner Electroplating School, now entering its third year, is presently accepting enrollments in its newly revised correspondence course in modern electroplating practice, Electroplating Know How.

The school is licensed by the Department of Public Education of the Commonwealth of Pennsylvania, and the course is recognized throughout the 48 states for vocational training in modern electroplating techniques. It is given under the personal supervision of Joseph B. Kushner, Consulting Electroplating Engineer.

New sections have been added on the conservation and efficient use of materials, specification plating, and improving teamwork in the plating department. In addition, new material has been added on recent advances in chromium plating, treatment of plating wastes, PR plating, electropolishing, and alloy plating.

A certificate suitable for framing is awarded to those men and women who

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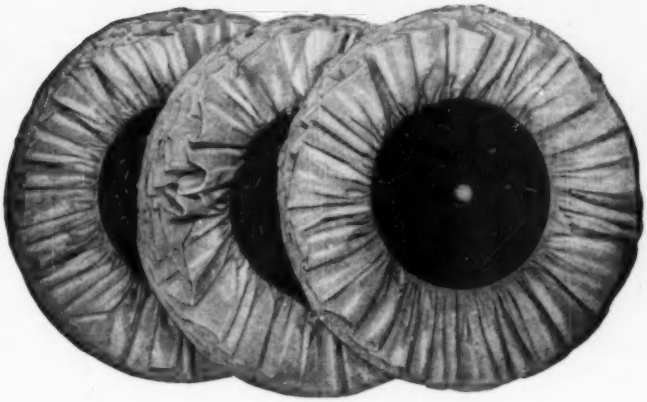
RELIANCE PRODUCTS



NUWAY BUFFS

MANY FOLDS TO HOLD COMPOSITION USED FOR FAST CUTTING, FLAT AND ROUND SURFACE WORK.

EXTRUDED COMPOSITIONS

MORE COMPACT, NO LOSS FROM BREAKAGE, MORE ECONOMICAL.

RELIANCE MIDGET PLATING BARREL

TUB CAN BE LIFTED OUT FOR DUMPING AND TUMBLING BARREL INSERTED FOR TUMBLING INSTEAD OF PLATING—VERY RIGID—THREE SPEEDS.

Chas. F. L'Hommedieu & Sons Co.

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Plating and Polishing Machinery

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and
Los Angeles

Industry News

complete the course with grades of 75 per cent or better. While the course may be started at any time during the year, early fall enrollments are advised, as only a limited number of students are accepted during a given time period. For complete details and enrollment forms, write to the Joseph B. Kushner Electroplating School, Stroudsburg 1, Pa.

Hagan Moves Los Angeles Office. A new Los Angeles district office has been established at 3921 Tweedy Boulevard, South Gate, Calif., by Hagan Corporation and its subsidiaries, **Calgon, Inc., Hall Laboratories, Inc.,** and **The Buromin Company.**

Fine Organics, Inc., 211 E. 19th Street, New York 3, N. Y., announces its intention to enter the industrial market. To do this the Aviation Chemicals Division has been broadened in scope and will become the Aviation-Industrial Division. The Division will continue under the direction of John B. Moore, who has been appointed General Sales Manager of Aviation and Industrial Chemical Sales. Among products of interest to platers are safety solvents, emulsion degreasers, and paint strippers.

Arthur K. Meyer Company has been appointed representative in Los Angeles County. Sales offices are now located at 1206 S. Maple Avenue, Los Angeles 15, Calif.

Charles H. Cadiz, formerly Superintendent of Maintenance of TACA Airways, has joined the Company as Southern sales representative for both Aviation and Industrial lines. He lives at 3326 Louisiana Avenue Parkway, New Orleans, La.

Second Plant Maintenance Show and Conference. The Show, which drew industrial executives from 35 states and many foreign countries early this year, will be held again in the Auditorium, Cleveland, Ohio, on January 15–18, inclusive, it has been announced by Clapp & Poliak, Inc., the exposition management, 341 Madison Avenue, New York 17, N. Y.

Also to be repeated will be the Plant Maintenance Conference which attracted approximately 1,500 engineers and executives, one of the largest attendances recorded at technical sessions of this type, L. C. Morrow, consulting editor, Factory Management & Maintenance, will serve as chairman.

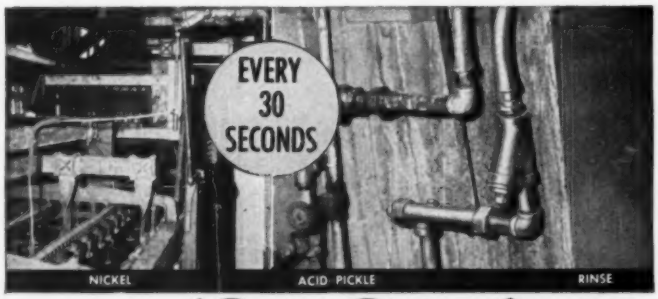
The Electrochemical Society Buffalo Meeting. A number of papers of interest to platers will be presented, as follows:

On Thursday, October 12, at 9:20 A. M.: "Surface Preparation of Nickel Silver, Brass and Copper for Electroplating" by Daniel Gray; "Cleaning and Etching of Aluminum Alloys" by W. R. Meyer; "Disphase Metal Cleaning in Electroplating" by F. D. Snell and Irving Reich; "The Influence of Surface Active Agents on Pickling Brittleness in Carbon and Stainless Steel" by C. A. Zapffe and M. E. Haslem.

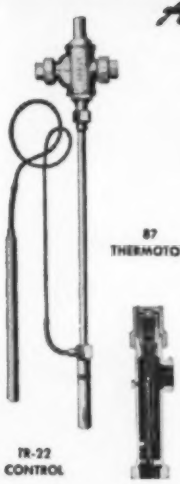
On Thursday, October 12, at 2:00 P. M.: "Water-Break Type Tests for the Evaluation of Metal Cleaning," by S. Spring; "The Detection and Estimation of Oils on Metal Surfaces with Ultraviolet Light Procedures" by O. M. Morgan and L. F. Hoyt; "Detection of Soil Removal in Metal Cleaning by the Radioactive Tracer Technique" by J. C. Harris, R. E. Kamp and W. H. Yanko; "Soil Removal Testing and Cleanliness Evaluation" by A. Mankowich; "The Ascyclic Generator for Electrolytic Processing" by G. J. Berry.

On Friday, October 13, at 9:00 A. M.: "The Cathode Polarization Potential during the Electrodeposition of Copper, I" by L. L. Shreir and J. W. Smith; "Theoretical Analysis of the Current Density Distribution in Galvanic Baths" by Carl Wagner; "Plating Experiments with Aqueous Solutions at High Temperatures" by Seymour Senderoff and Abner Brenner; "The Anode Layer in the Electrolytic Polishing of Copper" by H. F. Walton; "Studies of Hydrogen Embrittlement in Cadmium Plated Steel" by Robert Weast; "Mechanism of Mass Transfer in Cathode Films during Electrodeposition" by R. R. Banks and H. B. Linford; "Electrolytic Hexagonal Nickel" by Ling Yang.

On Friday, October 13, at 2:00 P. M.: "The Effect of Pure Organic Compounds on Crystal Size in Copper Electrodeposition, I" by Martin Chanin, W. P. Roth, H. R. Roth and J. H. Lane; "The Effect of Indium in Electrodeposited Chromium" by Norman Hackerman and Tyleen Jensen; "Electrodeposition of Rhenium-Nickel Alloys" by L. E. Nether-



A Perfect Plating Operation



Automatic plating units never wait. When they hit the tanks, the temperature must be right and in less than a minute the job must be done—right. In the busy plating plant illustrated, every step is temperature controlled—sometimes with the inexpensive Sarco No. 87 Trap-Control—at others with the more exacting TR-22 control.

The result is mass production with a high accuracy that is repeated, day in and day out. Reduction in the number of rejects paid for these controls in a few months. And the strange thing is that less heat is wasted when perfect plating is secured with Sarco Controls.

Eventually you will find your plant in competition with temperature controlled plating. Why not look into the question now and save the original cost of the controls over and over for years to come? The Sarco Representative near you will be glad to show you how. Ask for Sarco Catalog No. 650 on plating and finishing controls.

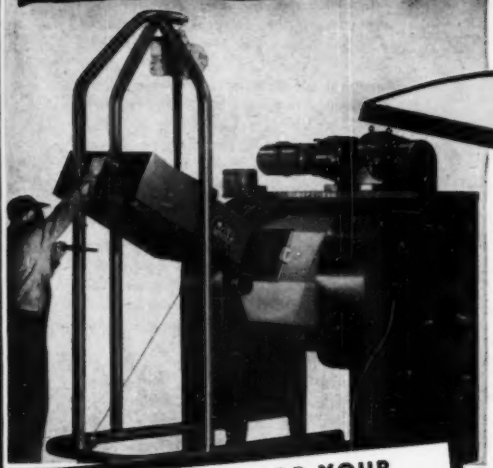
186

SARCO SAVES STEAM

SARCO COMPANY, INC.
Represented in Principal Cities
Empire State Building, New York 1, N. Y.
SARCO CANADA LTD. TORONTO 7, ONTARIO

DO ALL OF THESE PARTS WITH "ONE OPERATION" MASS PRODUCTION FINISHING AT A COST SAVING OF UP TO 95% WITH

ALMCO **Supersheen**
A Better Finish-FASTER



EQUIPMENT FOR YOUR SPECIFIC NEEDS

(1) Advanced Design PRECISION Tumbling barrels in sizes from 8" x 16" up to 60" x 30". (2) AUTOMATIC loading, unloading and separating equipment. (3) A vastly SUPERIOR grinding and finishing medium in 2 grades and 9 sizes.

DEBURR

Flat or formed stampings — **all** types and sizes . . . long, thin, slotted, etc. All common metals, including magnesium and copper. Machined parts with large burrs. Large, heavy or extremely light parts can be "one operation" processed without damage.

CUTTING DOWN, POLISHING, BURNISHING, PUTTING ON RADIUS

Castings — **all** types — **all** common metal alloys. Forgings before and after machining. Machined parts. Stampings requiring smooth surfaces and high colors.

DESCALE, DEBURR, POLISH

Forgings before and after machining. Heat treated parts. Welded or discolored parts.

COMPLETELY FINISH FROM CASTING OR FORGING TO PLATING OPERATION

Forged or cast brass, iron. Die castings of all sizes, shapes and types.

ALSO

Selective grinding. Low micro-inch surfaces equal to lapped finishes can also be obtained with absolute uniformity.

● GET THESE BENEFITS

A Better Finish **Faster** on widest range of parts. Reduced time, labor and material costs . . . **up to 95% saving!** Reduced rejections — stepped-up production. Unsurpassed uniformity — improved finish.

● OUR SERVICE TO YOU

We survey your requirements — determine by Trial Runs if ALMCO SUPERSHEEN is applicable. Furnish Engineering Data Card — specific fool-proof instructions on how to run each part. Train operators for highest efficiency. Furnish continuing information on latest finishing procedures.

FREE *Engineering Clinics*

Nationwide Network provides you with QUICKER and BETTER sample processing. Write today for details. Or send unfinished samples for FREE Engineered Pilot Run and complete production cost data.

FREE SAMPLE PROCESSING
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Please send me latest descriptive literature and address of nearest SUPERSHEEN Engineering Clinic.

NAME_____

ADDRESS_____

_____

America's Most Versatile "ONE OPERATION" Finishing Process

Why Wyandotte bought a Pacific Coast plant—and what it means to you

On June 15, Wyandotte Chemicals Corporation announced the purchase of the Pacific Chemical plant of the American-Marietta Company of Los Angeles, California. The plant is now being revamped as a Pacific Coast manufacturing unit for Wyandotte products. Sales and plant personnel are being absorbed by Wyandotte.

WHY

For well over a quarter of a century there have been Wyandotte branches in Los Angeles, San Francisco and Seattle. They have been part of a rapidly growing industrial market. This new manufacturing plant will allow them to better serve their Coastal and Western customers.

WHAT IT MEANS TO YOU

If you are located west of the Continental Divide, you will get the advantages that come naturally from being close to the source of supply. If you have been a user of Pacific Chemical's products, you will have made available to you the Wyandotte Research and Technical Service staffs, numbering nearly 200 persons. If you buy cleaners for aircraft, automobiles, railroads or **any** metal finishing operation, you will benefit from the exchange of technical experience that is now taking place.

But in our eyes the great significance of this move is as evidence of Wyandotte's steady and continued growth in serving your industry.

THE WYANDOTTE LINE — products for burnishing and burring, vat, electro, steam gun, washing machine and emulsion cleaning, paint stripping, acid pickling, related surface treatments and spray booth compounds. An all-purpose floor absorbent: Zorball — in fact, specialized products for every cleaning need.

WYANDOTTE CHEMICALS CORPORATION
WYANDOTTE, MICHIGAN
SERVICE REPRESENTATIVES IN 88 CITIES

Wyandotte
REG. U. S. PAT. OFF.

Industry News

ton; "New Correlative Instrumental Analyses of Textures and Properties of Nickel Electrodeposits" by G. L. Clark and S. H. Simonsen; "Preparation of Tin Wire by Electropolishing" by W. H. Colmer, Morris Feinleib and H. T. Francis.

Headquarters is the Statler Hotel, Buffalo, N. Y.

German Experts in U. S. Two leading German authorities on cold extrusion of metal, Dr. I. W. Overath, Technical Director, and Dr. H. R. Ley, Director of Chemical Laboratories, Metallgesellschaft A.-G. in Frankfurt a. Main, recently spent two weeks in Detroit for exchange of information with Dr. Robert Gibson, Technical Director, and J. F. Leland and H. J. McVey, Development Engineers of Parker Rust Proof Company. During the war Metallgessellschaft did remarkable work in the cold extrusion of steel. Since 1946, it has further developed the technique of treating and lubricating with the employment of Parker's Bonderite and now has many applications in peacetime production.

Pennsalt 100 Years Old. When the Pennsylvania Salt Manufacturing Company was organized in September, 1850 there were only 51 persons employed in America's infant steel industry. Cast and wrought iron, brass, copper and bronze, laboriously machined, finished and polished by hand, were the metals of our young industry. What chemicals were used in metal working were few and basic, and the great scientific advances which were to weld chemistry and metallurgy together were still to come.

Today the steel and aluminum industries are two of Pennsalt's largest customers, and virtually every other phase of America's vast metal-working industry is served by some product of this century-old chemical manufacturer.

Pennsalt was organized by five young Philadelphia Quakers to manufacture "the alcaline salts of soda". Since most of the eastern-seaboard industries were importing what chemicals they used from Europe, the company's founders chose the expanding Midwest for their market and built their first plant at its gateway—at Natrona on the Allegheny river near Pittsburgh.

As the steel industry grew in the Pittsburgh area, Pennsalt began to supply it with chemicals—at first acids for pickling

Federated ANODES

for the Plating Trade

COPPER Anodes . . . M-Sterling Chill-formed in flat, oval, wedge, and ball shapes. Open mold shapes also available. All of prime electrolytic copper.

COPPER Anodes . . . electro-deposited, in all standard sizes . . . special sizes to order.

LEAD Anodes . . . the M-Sterling Dated Conducta-Core Anode with specially designed strong hooks coated to protect against acid fumes and spray.

TIN Anodes . . . flat and oval shapes . . . all standard sizes . . . made only of extra high purity tin.

ZINC Anodes . . . only of Special High Grade zinc in all standard sizes and shapes.

BRASS Anodes . . . full range of analyses . . . flat, oval, wedge, and ball shapes.

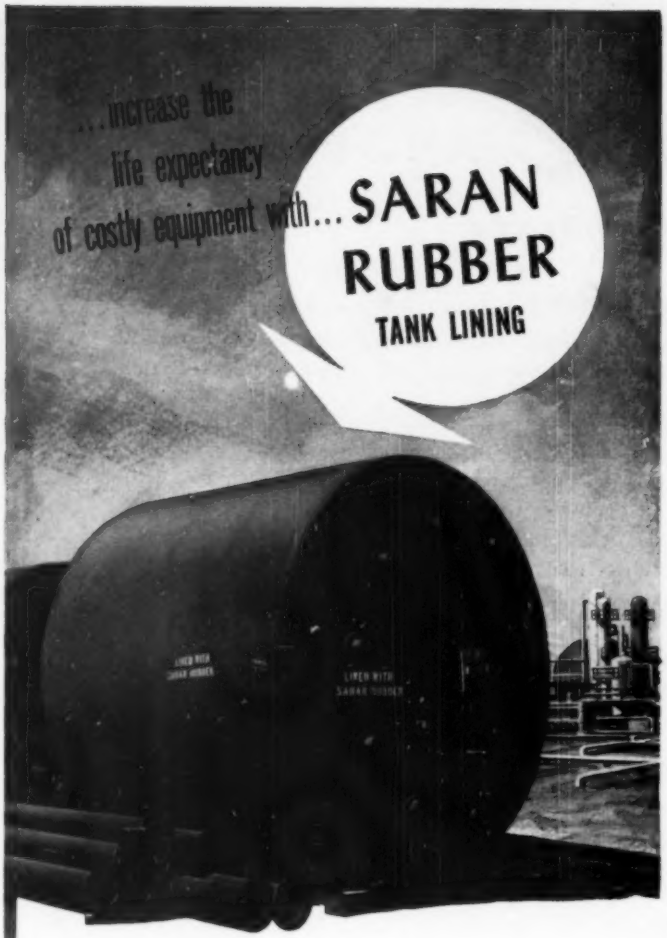
Federated Anodes are sold through offices in 22 principal cities. Quality is continuously controlled by Federated metallurgists so that the anodes are free of gates, flash, and cavities . . . of high chemical purity . . . to give uniform plating performance.

Federated first in the non ferrous field FMD

Write, wire, or phone for complete information

Federated Metals Division

American Smelting and Refining Company, 120 Broadway, New York 5, New York



Saran rubber, one of Dow Chemical's superior developments in tank linings, has combined the physical properties of rubber with the chemical resistance of saran. This high degree of chemical and abrasive resistance makes saran rubber an outstanding lining where resistance to grease, solvents, acids and other chemicals is indicated.

Saran rubber can be applied easily, effectively and economically by experienced tank lining applicators located strategically throughout the country.

Get in touch with an applicator today by contacting your nearest Saran Lined Pipe Company office —and find out how you can preserve the life of costly equipment.

Distributed by

Saran Lined Pipe Company

2415 BURDETTE AVE., FERNDALE 20, MICHIGAN

Offices in: New York • Boston • Philadelphia • Pittsburgh
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DOW

Industry News

and later others. In 1864 Pennsalt began importing cryolite from Greenland as a source for soda alkalies and alum. A by-product was calcium fluoride, which the company sold to early steel makers as a flux.

Beginning in the 1870's and until after World War I, Pennsalt was a small but active producer of metals. As a source of sulfur, the company imported pyrites from Spain. This ore also yielded small but profitable amounts of copper, gold, silver, and iron oxides. The non-ferrous metals were refined in Pennsalt's Natrona plant and a newer one at Greenwich Point in Philadelphia.

During this period Pennsalt played an important part in one of America's most exciting industrial developments. Charles Martin Hall, in 1886, discovered that Pennsalt's cryolite was, in its molten state, the electrolyte for reduction of aluminum. The new use for the Greenland ore quickly overshadowed all others, and today it plays an essential part in our aluminum production.

In addition to supplying cryolite to the Pittsburgh Reduction Company. (later Alcoa), Pennsalt was in position to furnish the basic ingredient, alumina, from its recently acquired Bayer process, the first in America.

Hall's remarkable achievement greatly interested Pennsalt in the whole field of electrochemistry, and it is interesting to note that the company's first experiments in this field were in refining copper and other metals. It was this work which eventually led the company into electrolysis of brine to produce caustic soda, chlorine, and hydrogen in a new plant at Wyandotte, Mich.

The few uses for chlorine in the early 1900's definitely limited the caustic soda production. Therefore, outlets for this comparatively new gas were eagerly sought. Once again metallurgy played an important role. Pennsalt's first large chlorine customer was the Goldschmidt Detinning Company (later the Metal & Thermit Corporation), which used quantities to recover tin from scrap.

Throughout its history Pennsalt had sought to sell its chemicals in as many different industries as possible. But in 1928 Leonard T. Beale, then president of the company, called for an active diversification program, seeking new products for more fields through research and acquisition of patents and plants.

A notable result of the research was the successful production in 1935 of anhydrous sodium orthosilicate for metal cleaning. Quickly proving itself, this product launched Pennsalt in the production of metal cleaners.

As the use of orthosilicate cleaners expanded through the middle '30's, Pennsalt research developed several modifi-

CASE HISTORY NO. 219

(Letter received from the Mergenthaler Linotype Company, March 31, 1950.)

The Roto Finish Company
Kalamazoo, Michigan

Attn: Mr. D. T. Barrett, Pres.

Gentlemen:

We have been using the Roto Finish Process on various Steel, Brass and Cast Iron parts for a period of two and one-half years. We are glad to report we have effected saving to justify purchasing a three machine installation with magnetic separator.

Roto Finish Process has considerably reduced our hand deburring and polishing and has given us a more uniform quality.

Sincerely,
MERGENTHALER LINOTYPE COMPANY
(Signed) G. W. Allison
Vice President & General Works Manager

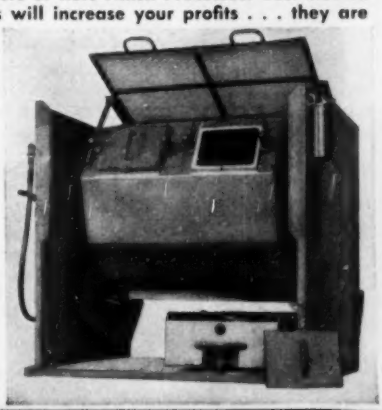
MERGENTHALER LINOTYPE PROVES IT!

The Mergenthaler Linotype Company, of Brooklyn, N.Y., is just one of many industries in diversified fields who have proven to their satisfaction that Roto-Finish Processes do a better finishing job faster, at less cost, than other methods.

Roto-Finish Processes will reduce your finishing costs with savings as high as 80%, increase your production, and give you greater uniformity. This is proven by countless users of Roto-Finish Processes. Cost studies show actual cost reductions from 25% to 80%. Roto-Finish Processes will increase your profits . . . they are "the rolling stones that gather dollars."

The original Roto-Finish System of controlled rotary action grinds, descales, deburrs, polishes, britehones and colors metals and plastics faster, with greater uniformity, at less cost, than other methods. Initial installation costs are moderate. Roto-Finish requires no expensive exhaust equipment.

Write today for the full story of "the rolling stones that gather dollars."



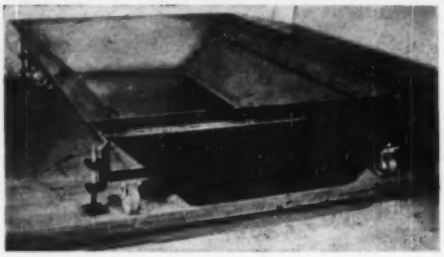
MAKE US PROVE IT! SEND US YOUR SAMPLES

OR, better still, bring your samples personally to the Roto-Finish Plant. See Roto-Finish Sample Processing Department finish your parts . . . prepare a report, furnish cycle time, estimate cost of labor and materials, and determine the chips and compounds best suited for your operation. We cordially invite you to visit us, and under no circumstances are you under any obligation. If you are unable to come to the Roto-Finish Plant, we shall be happy to process your parts and return them to you with all pertinent information regarding their finishing.

Roto-Finish COMPANY KALAMAZOO, MICH.

ORIGINATORS OF THE ROTO-FINISH PROCESSES

ROTO FINISH



Need something special in tanks?

STORTS engineering help in designing your special purpose tanks assures provision for needed structural strength along with adaptability to special production requirements. And Stortswelded fabrication is your best way to be sure of complete satisfaction and long, trouble-free service life.

42 STONE STREET — STORTS WELDING COMPANY INCORPORATED — MERIDEN, CONN.

Manufacturers of Welded Fabrications to Specification

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1003.

INSURANCE

You carry insurance on your Business, House, Car and Life. Why not on your plating tanks? They are the life blood of your business. It's cheap insurance to protect your equipment and production from baffling, costly and invisible short circuits by installing TRUE INSULATORS in your steam, water and air lines.

The
TRUE
Insulator

is manufactured especially for insulating plating tank coils; is of rugged construction, and easily installed.

Provides two inches of absolute insulation.

Fitted at each end with male couplings which grip the Rayon Braided Steam Hose permanently; and become an integral part of your steam, water and air lines.

Are available in the following sizes:

½ inch..... $6.50 per pair
¾ inch..... 6.50 per pair
1 inch..... 7.50 per pair

Discounts allowed for quantity purchases; special sizes considered for special uses.

TRUE BRITE CHEMICAL PRODUCTS

P. O. Box 31, Oakville, Conn.

PRACTICAL PRODUCTS FOR PRACTICAL PEOPLE

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1004.

Industry News

cations and specialties based on the original product to meet a wide variety of needs. Among those actively interested in the program during this time were George B. Beitzel, then Sales Manager and now

Beitzel

Pennsalt President; William P. Drake, now Sales Vice-President; and Joseph J. Duffy, Jr., now Manager of the company's Special Chemical Department.

Duffy Drake

One of the early uses for the orthosilicate cleaners was in the cleaning of sheet steel for tinplate. One of their first successes was in tin-mill cleaning lines running at the rate of 150 feet per minute. Now a successor product is operating just as successfully on lines running 2,400 feet per minute.

It is interesting to note that what is said to have been the first reverse-current cleaning cycle, developed at the Ford Motor Company in 1937, used a Pennsalt cleaner. As development of the product grew, so did manufacturing procedures, and between 1937 and 1939 the company developed a modern cleaner plant at Wyandotte, Mich.

In 1939 the company formed the Pennsalt Cleaners sales department. With the addition of Pennsalt's corrosion-resistant cements and paints in 1941, this became the Special Chemicals Department. Exact figures are not known, but it is believed that more than 85 per cent of all small-arms ammunition produced in America during the war was cleaned with Pennsalt cleaners.

With the war's end, Pennsalt resumed research and soon went into production of inhibited-acid cleaners for descaling, emulsion cleaners, maintenance cleaners, rust inhibitors, and many other products for the metal industry. One of the latest, recently announced, is an aluminum etching compound. Today Pennsalt's

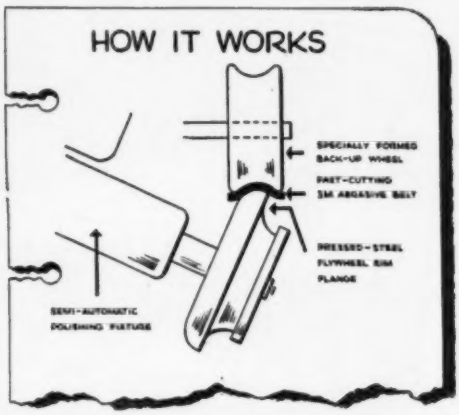
"Formed-wheel" belt grinding cuts 3-step job to one!

SEMI-AUTOMATIC polishing fixture spins and turns 20" pressed-steel wheel against fast-cutting belt. Savings with 3M Abrasives soon pay for equipment and automatic fixtures. Belt back-up wheel is specially formed to mate with curve of flywheel flange. Formed-wheel belt grinding can cut *your* grinding costs, too!

3M Abrasives slash grinding time 71% at American Type Founders

Time study figures prove it! Formed back-up wheels and 3M Abrasives are saving American Type Founders $1.15 on every "Little Giant" press flywheel they finish. A one-step operation now gives these wheels a smoother, cleaner surface in only 7¼ minutes instead of 25 minutes with the former 3-step method.

Diagram below shows how formed back-up wheel matches the contour of the flywheel rim, gives uniform results, saves 71% on time alone.



You can make savings in time and money on *your* heavy grinding and finishing by consulting one of our experienced Methods Engineers. Just write Dept. P-105 for this service offered at no cost, no obligation.

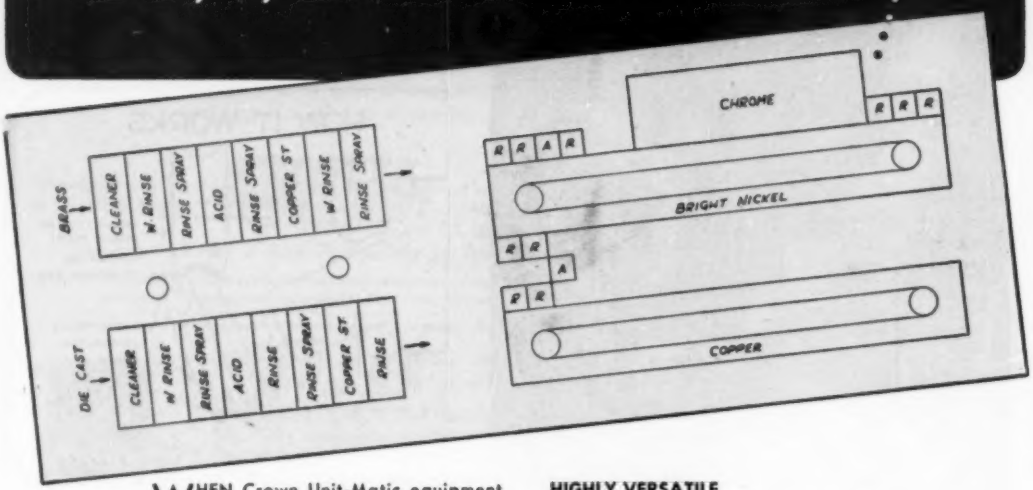
WE INVITE YOU TO USE OUR DEMONSTRATION ROOMS . . . work out faster, more economical grinding and finishing methods. A 3M Methods Engineer will grind your sample parts on modern belt grinding equipment, show you how to cut costs. For nearest location, address Dept. P-105

Made in U.S.A. by MINNESOTA MINING & MFG. CO., St. Paul 6, Minn., also makers of "Scotch" Brand Pressure-sensitive Tapes, "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-Slip Surfacing, "3M" Adhesives.
General Export: Durex Abrasives Corp., New Rochelle, N. Y.
In Canada: Canadian Durex Abrasives Ltd., Brantford, Canada.

CROWN

UNIT-MATIC mechanized plating

Brings you MANY ADVANTAGES



WHEN Crown Unit-Matic equipment mechanized the cleaning and plating operations in this Plating Shop it brought many advantages . . . lower costs . . . improved quality . . . higher production . . . more profits.

WIDE APPLICATION

Whether your production is 40 racks of work per hour or 400 racks per hour you can mechanize your electro plating department with Crown Unit-Matic Plating Equipment.

HIGHLY VERSATILE

The layout shown here processes DIE CAST and BRASS parts, as well as a few steel parts. Any of the cleaning, copper Plating, Brite Nickel or the chrome Plating treatments, or the time cycle, can be quickly changed without disturbing the other treatment cycles.

Write for a bulletin giving further information

CROWN RHEOSTAT AND SUPPLY COMPANY

3465 NORTH KIMBALL AVENUE • CHICAGO 18, ILLINOIS

"Plating Costs Go Down When Crown Unit-Matic Plating Equipment Goes In"

PROMAT

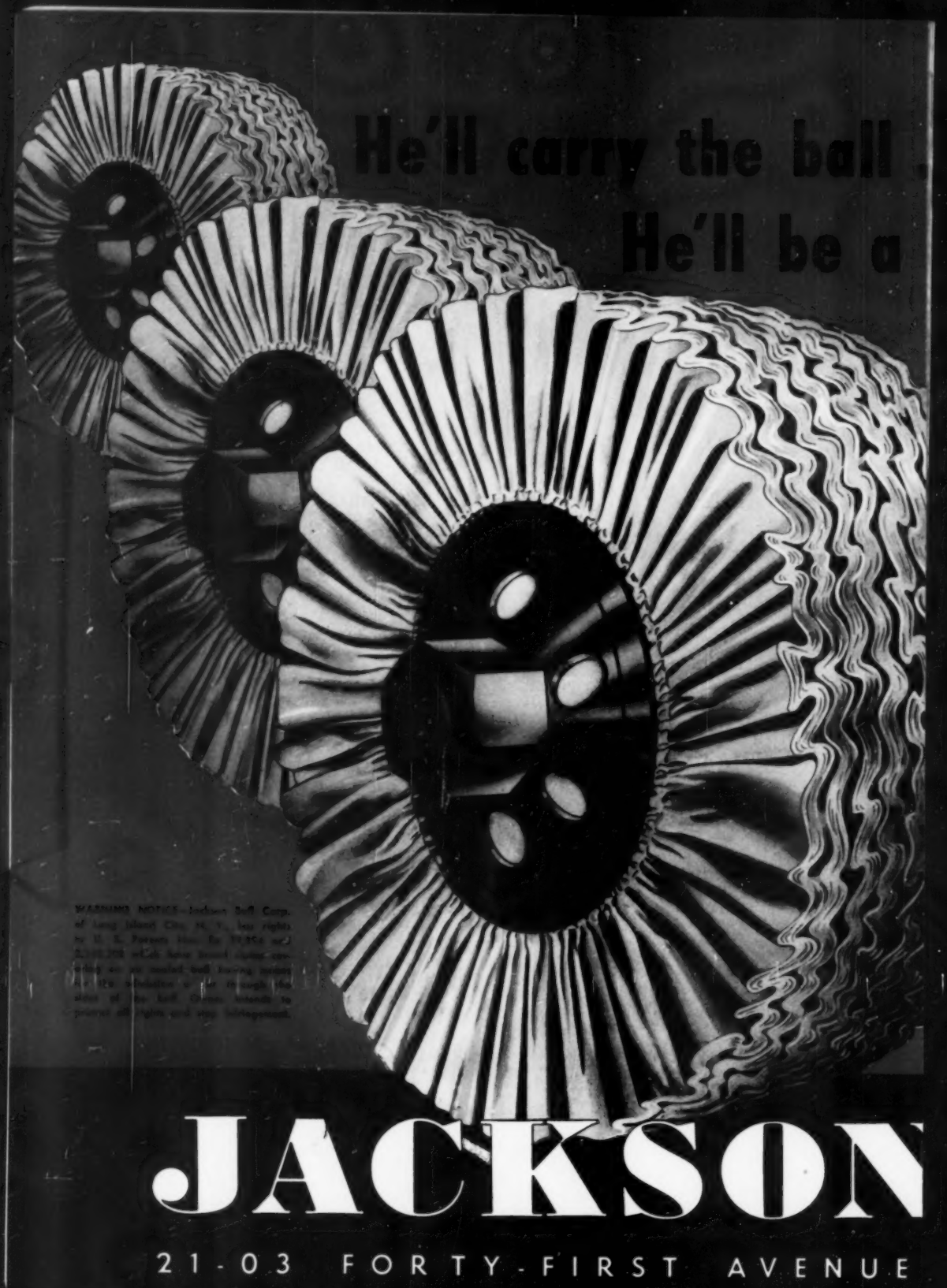
Pro-Seal® finish

A superior, bright protective finish for zinc where the maximum in corrosion resistance and appearance is desired.

PROMAT DIVISION, Poor & Company
851 South Market Street, Waukegan, Illinois

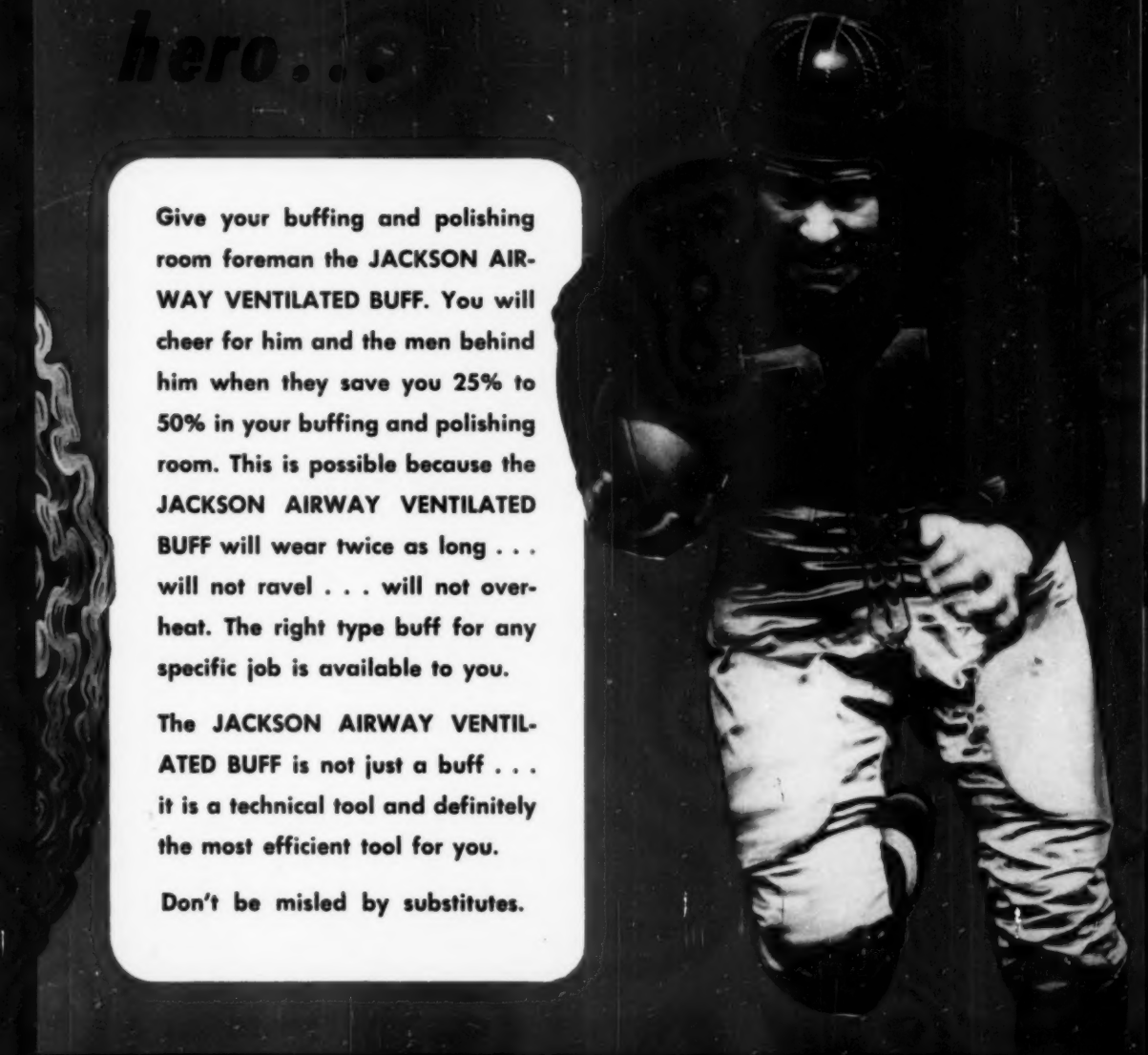
Like "Sterling" on Silver

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1007.


He'll carry the ball.
He'll be a
JACKSON
21-03 FORTY-FIRST AVENUE

. . . everybody will cheer for him

hero . . .



Give your buffing and polishing room foreman the JACKSON AIRWAY VENTILATED BUFF. You will cheer for him and the men behind him when they save you 25% to 50% in your buffing and polishing room. This is possible because the JACKSON AIRWAY VENTILATED BUFF will wear twice as long . . . will not ravel . . . will not overheat. The right type buff for any specific job is available to you.

The JACKSON AIRWAY VENTILATED BUFF is not just a buff . . . it is a technical tool and definitely the most efficient tool for you.

Don't be misled by substitutes.

AIRWAY Ventilated

BUFFS

LONG ISLAND CITY 1, N. Y.

FLUID-FILM was designed for STEEL STAMPING . . . regardless of size, depth of draw, radii, etc. —If it can be done with a pigmented compound, it can be done to advantage with non-pigmented FLUID-FILM—and a little of it goes a long way . . . FLUID-FILM U-19 is what we recommend for steel. Readily applied as is, or it may be diluted with water or oil up to two parts of diluent to one of compound . . . FLUID-FILM is rust inhibited and is easily applied—rolled, dipped or sprayed —weld through it, anneal it—obtain a perfect job without precleaning and with practically no residue . . .

HALF *Fluid-Film*

the other

HALF *metal cleaner no.78*

Clean STEEL STAMPINGS, drawn with FLUID-FILM, by immersion in the latest plant proven Steel Cleaner, especially developed for this purpose; NORTHWEST Metal Cleaner No. 78 . . . Normal concentrations of from six to eight ounces per gallon does the job rapidly and efficiently—its long life makes it economical . . . Equally adaptable for cleaning steel parts by immersion prior to plating, bonderizing, painting or vitreous enameling . . . *A request on your letterhead will bring a technician to consult you on your drawing and cleaning problems . . .*

the Whole . . .
story is that it has been proven logical that the same technicians who supply the correct lubricants for drawing metals also provide the material for making them chemically clean afterward.

NORTHWEST CHEMICAL CO.
9310 ROSELAWN DETROIT 4, MICH.

. . . serving you since '32

Industry News

Special Chemicals Department handles more than 50 chemical specialties for the metal industry.

Among the users of these products are approximately 90 per cent of America's tinplate producers; the automobile industry; most of the large metal fabricators of such products as household appliances, metal furniture and fixtures, and procelain-enameled products; aircraft manufacturers, and many others. Aiding Pennsalt sales, manufacture, and research in these fields is an active service program.

In addition to the special chemical work, Pennsalt's Heavy Chemicals Department is supplying many products to the metal industries, such as hydrofluoric, muriatic nitric and sulfuric acids; anhydrous ammonia, caustic soda, cryolite, sal ammoniac and many others.

Extremely Fine Wire by Electropolishing. Extremely fine, 0.00015-inch, wire for miniature electronic equipment is being made by electropolishing of larger wire at the Armour Research Foundation, Chicago, Ill., according to Dr. Howard T. Francis. The process is still in an experimental stage, and further research will determine how it will work with various metals and just how fine a wire can be made and used practically.

Employee and Public Relations Division formed by Wyandotte Chemicals. George H. Baker, recently active with American Potash & Chemical Corporation in similar activities, will head the new division, which will coordinate all human-relationship activities of the company.

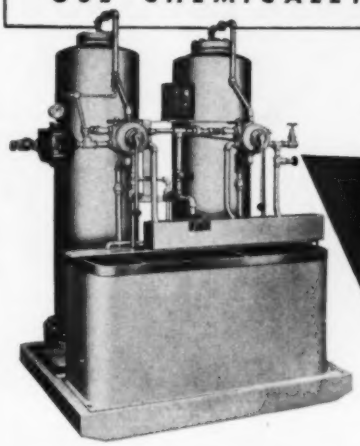
Baker

U. S. Naval Ordnance Plant, Indianapolis, Ind., now has vacancies for mechanical, electronic, electrical, and ordnance engineers. These positions are at various grade levels under Federal Civil Service at annual salaries ranging from $3,825.00 to $7,400.00. Full details concerning employment at this station will be supplied by Commander M. K. Coleman, USNR, Industrial Relations Officer.

The Kirk & Blum Mfg. Company, Cincinnati, Ohio, dust- and fume-control manufacturer, recently acquired the entire plant and property of The Cincinnati

Eliminate Hot-Rinse Stains Unwanted Precipitates

USE CHEMICALLY PURE WATER



only a few cents a thousand gallons *with* . . . .

INDUSTRIAL Water Demineralizers

A Two-Bed INDUSTRIAL Water Demineralizer. Standard two- and four-bed units available with capacities of 200 to 1000 gph. Special units of any capacity engineered to requirements.

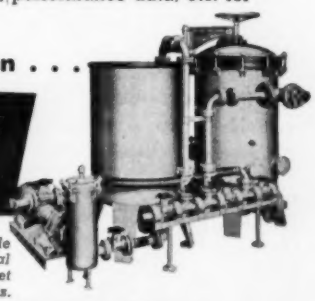
and it's as simple as it looks . . .

besides the extremely low cost, there is nothing complicated about getting the chemically pure water with Industrial Demineralizers. Raw water is passed through either two or four beds of ion-exchange resins and it comes out free of the dissolved mineral salts. No still, heat, steam, or cooling water is needed—keeping space requirements relatively small.

And it's simple to get the complete facts for your case. Send us a water analysis and let us know how much water you have to treat and the gallons per hour needed. We can then give you the whole demineralizer story including estimated costs, equipment required, performance data, etc. for your requirements.

for solution clarification . . .

use an **INDUSTRIAL Filter**



100 to 15,000 gallons per hour. Portable and stationary models. Standard or special filtration systems engineered to meet unusual requirements.

Write for full information and recommendations

FILTERS Pressure Type · PUMPS Centrifugal · CORROSION TESTING APPARATUS Salt Fog • Humidity

INDUSTRIAL FILTER & PUMP MFG. CO.

5914 Ogden Ave.
Chicago 50, Illinois

RUBBER DIVISION Vulcanized Linings • Molded Products · WATER DEMINERALIZERS

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10 PRACTICAL REASONS FOR USING B&A NICKEL FLUOBORATE SOLUTION

For Faster Better

Barrel Plating

FOR FASTER AND BETTER RESULTS in barrel plating of nickel finishes, Baker & Adamson Nickel Fluoborate Solution offers important advantages. For example, its higher conductivity is just one feature contributing to improved efficiency and increased economies. Other benefits are listed at the right. Review them. Consider what they can mean to *your* production in barrel plating operations!

If you are seeking new and better methods . . . reduced costs . . . and stepped-up profits, investigate B&A Nickel Fluoborate Solution without delay.

Full information and helpful technical data available on request from nearest Baker & Adamson Office listed below.

Advantages of B&A Nickel Fluoborate Solution

1. **Higher Conductivity.** Saves *time* and *power* . . . plating rate in the Nickel Fluoborate bath is *twice* that of sulfate chloride baths at the same voltage!
2. **Good Throwing Power** . . . throwing power of Nickel Fluoborate bath at these higher plating rates is equal to the sulfate chloride bath at its usual plating rate.
3. **Fine-Grained** ductile deposits with improved color are obtained.
4. **Economical** . . . cost of bath maintenance is extremely low.
5. **Bright Finishes** are possible.
6. **Simplified Control** . . . bath requires only a colorimetric pH and a hydrometer reading for control.
7. **No Unsightly Deposits** on tanks and equipment since the nickel salts are highly soluble.
8. **Stable** . . . bath is extremely stable as to pH changes, with minimum of sludging.
9. **Less Sensitive** to metallic impurities, thus reducing purification operations.
10. **Ease of Bath Make-up.** Solution is ready-to-use; no dissolving necessary.

REAGENTS
B&A
STANDARD OF PURITY
FINE CHEMICALS

BAKER & ADAMSON *Fine Chemicals*

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SETTING THE PACE IN CHEMICAL PURITY SINCE 1882

* Complete stocks are carried here.

Industry News

Planer Co. The plant, located at 3120 Forrer Street in suburban Oakley, will be occupied by Kirk & Blum about the end of the year.

Eight acres of ground surround the facilities, which include over 100,000 sq. ft. of one-story manufacturing and storage space, all under one roof, fronted by a two-story air-conditioned office and engineering building. The company's five warehousing and manufacturing facilities, now scattered throughout Cincinnati, will be consolidated in the Oakley plant.

A.S.T.M. Committee B-8 on Electrodeposited Metallic Coatings will hold meetings in Hotel Statler, Buffalo N. Y., on October 9–11 in conjunction with the Fall Meeting of The Electrochemical Society.

The Advisory Committee and Subcommittee sections will hold closed meetings on Monday, October 9 and Tuesday A. M., October 12.

The following meetings are open to the public. On Tuesday, October 10: Subcommittees II on Performance Tests at 1:30 P. M.; IV on Electroplating Practice at 3:00 P. M. On Wednesday, October 11: Subcommittees V on Supplementary Treatment for Metallic Coatings at 8:30 A. M.; I on Papers, Specifications and Definitions at 10:00 A. M.; III on Conformance Tests at 1:30 P. M.; Main Committee at 3:00 P. M.

Industrial Finishing Exposition in Chicago in 1952. Clyde Kelly, Chairman, has announced that his Exposition Committee, besides Vice-Chairman H. E. Head, will consist of W. O. Zinn, President of the National Association of Metal Finishers, Detroit; Leonard E. Weeg of the National Lock Company, Rockford, Ill.; and Walter C. Dietrich, Advertising Manager of PLATING.

The Committee met in Chicago on August 19 for preliminary discussion.

Electrodepositors' Technical Society, England, at its spring meeting on May 15, elected to its council H. Cann, Dr. J. W. Cuthbertson, E. J. Dobbs, J. Hooper, E. H. St. Clair Moorey, C. W. Parker, and J. M. Sprague.

The Council appointed the following officers for the 1950–1951 Session:

President—A. W. Wallbank

Vice-Presidents—R. A. F. Hammond, A. W. Hothersall, H. Silman, W. E. Wright

Honorary Treasurer—F. L. James

Honorary Secretary—Dr. S. Wernick

Dr. Gardam serves as the Immediate Past President.

Newly elected Chairmen of the local centres are Dr. Cuthbertson, London; C. Harris, Midlands; and T. B. Bowker, Sheffield and North-East.

The 14th Annual Management Engineering Clinic scheduled for November 1–2–3, 1950 at the Sheraton Hotel in Chicago, is setting a new pre-conference record for advance registrations. With attention focusing on industry's "preparedness campaign," a capacity attendance of 2500 executives, plant managers, methods and time-study engineers is expected to learn the latest about job evaluation, wage incentives, production and cost controls. Among speakers scheduled to address the Clinic are: H. W. Anderson, Vice-President, General Motors Corporation, Detroit; Fred Maytag II, President, Maytag Company, Newton, Iowa; and Joseph Beirne, President Communications Workers of America, C.I.O.

Film on Automatic Control. Produced as one of the projects of the Instrument Society of America, 921 Ridge Avenue, Pittsburgh 12, Pa., the film "Principles of Automatic Control" presents the subject of automatic control to executives, production supervisors and operators, technical personnel and students. The film had its premier showing in Buffalo at the Fifth National Instrument Conference and Exhibit.

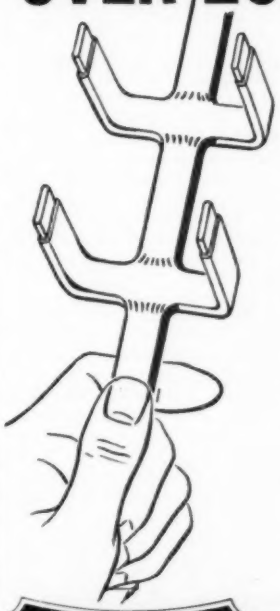
Excellent opportunity for experienced buffing composition salesman in Ohio and Michigan. Complete line of outstanding compositions and polishing room accessories. Knowledge of plating will be helpful. Replies held in strictest confidence.

Reply to:

P-1050A, PLATING

P. O. Box 168, Jenkintown, Pa.

COATING SURVIVES OVER 2500 CYCLES!



UNICHROME COATING 218X *again proves that it minimizes rack upkeep*

At a Michigan plating plant, Unichrome Coating 218X is considered to be "the best rack coating ever used." For good reason. Racks protected with this green plastisol coating have been working 16 cycles daily for 8 months — and the coatings are *still* in good condition!

Such service is not unusual for Coating 218X. It's one of the toughest materials — physically and chemically — that can be put on racks. It stands up in all plating baths, all cleaners — even vapor degreasers. Coating 218X is approved for leading bright nickels. Applicable in flexible coatings up to 3/16" thick, it won't tear or chip. And with but a *single* prime coat of Unichrome Primer 219PX used, you assure not only better adhesion, but savings in application time as well.

A United Chromium engineer is always ready to show you how to apply Coating 218X for top results. Or if you have no baking facilities, we'll gladly send you names of nearby qualified applicators who can apply it for you. Either way, you stand to gain substantial savings in rack maintenance. Send for data.

UNICHROME Trade Mark **COATINGS for METALS**

Metallic ..... Organic ..... Decorative ..... Protective

Products of UNITED CHROMIUM, INCORPORATED

100 East 42nd St., New York 17, N.Y. • Detroit 20, Mich. • Waterbury 90, Conn. • Chicago 4, Ill. • Los Angeles 13, Calif. • In Canada: United Chromium Limited, Toronto, Ont.

CHEMCLEAN BREVITIES

Facts Without Frills

SEC

SOLVENT EMULSION CLEANER

Self	Emulsifying	Cleaner
Safe	Easy	Cleaning
Simple	Efficient	Cycles
Sure	Economical	Compound

SEC HAS THE FOLLOWING PROPERTIES

Non-toxic—Non-corrosive—Long life. Odorless—Use as is or as emulsion. Dip or spray—Room temperature to 140° F. Fast wetting — Rapid penetrating — Free rinsing.

AN OUTSTANDING PRE-SOAK FOR STUBBORN SOILS

Try it out - test it - with a TRIAL ORDER

CHEMCLEAN PRODUCTS CORP.

Manufacturers of Industria Cleaners, Strippers and Chemical Specialties.

64 Sixth Ave.
New York 13, N. Y.

"We can't make all the cleaners so we make the best."

Personals

Robert M. Norton, until recently Assistant Sales Manager, has been promoted to Sales Manager of Hanson-Van Winkle-Munning Company, Matawan, N. J. He

Norton

was for eight years field representative in New England and New York. Besides continuing to direct the sale of electroplating and polishing supplies, he will assist John A. Bauer, Vice-President, with general administrative problems.

R. A. Dittbrenner has been appointed Eastern Representative of the Carboline Company, St. Louis, Mo., and will also handle advertising and sales promotion for the Company's line of thermosetting and thermoplastic coatings and linings. Mr. Dittbrenner has been employed in corrosion work for the past 17 years.

Edward A. Green has been appointed staff assistant to A. W. Bartling, General Sales Manager of General Electric's small Apparatus Divisions, with headquarters at Lynn, Mass. He was formerly Manager of Sales of the Company's Control Divisions. In his new capacity, Mr. Green will assist in sales matters pertaining to controls, fractional-horsepower motors, industrial heating, lighting and rectiviers, meters, and instruments, small and medium motors.

Robert S. Herwig has been appointed Vice-President in charge of production of Belco Industrial Equipment Division, Bogue Electric Company, Paterson, N. J. A chemical engineer with seventeen years of experience, he has for the past five years been serving as Manager of Technical Sales.

John R. Rhinehart has been appointed Vice-President in charge of Engineering and Development. Mr. Rhinehart is a mechanical engineer with twenty-five years of experience in the water treatment field. Prominent among his developments has been the Company's fully automatic control valve designed for softeners and filters, hot-process softeners and vacuum deaerators, and the Belco Clarator used for rapid settling and precipitation of suspended solids.

George Apfel has been promoted from Assistant Manager to Manager of Technical Sales. He has many years of water treatment experience. During World War II he was responsible for the operation and maintenance of all Naval water facilities at overseas bases.

Mr. Robert A. Ree has been promoted to General Sales Manager. For the past two years he was Manager of the Swimming Pool division, in which position he developed the line of diatomaceous earth filters.

J. E. Upham, eastern New England representative of the Atlas Powder Company's Industrial Finishes Department for the past twenty-five years, retired on August 1, completing a sales career in finishes dating back to 1907. A group of his associates tendered him a farewell dinner on July 14 in Stamford, Conn., and presented him with a silver smoking set.

Mr. Upham's territory will be taken over by **George M. De Camp** of Winchester, Mass., and **Everett H. Jenks** of Providence, R. I., both of the Company's New England sales force.

E. D. (Pat) Casseday is now Houston District (Southeastern Texas) Sales Manager of Bridgeport Brass Company, succeeding **George Chatneuff.** Mr. Casseday was recently with Bridgeport's Los Angeles Office. He has been connected with the copper and brass industry for the past fifteen years.

Casseday

Dr. Robert H. Steiner has been appointed Research Coordinator of Atlas Mineral Products Company, Mertztown, Pa. He received his B.S. degree with highest honor and his Ph.D. degree from the University of Pittsburgh and has been employed by The Firestone Tire and Rubber Company for the past seven years.

Steiner

Richard P. Blake, formerly Division Manager of McAleer Manufacturing Company, Rochester, Mich., is now associated

For consistent quality in copper plating...

DU PONT

"COPPRALYTE"

Copper plating salts and addition agent

1

"COPPRALYTE" *Copper Plating Salt*
POTASSIUM FORMULATION

- High purity, readily soluble salt for potassium-type copper plating bath.
- Shows superior operating characteristics, higher current densities, greater tolerance to contaminating impurities.
- Permits economical operation because of low concentration of materials required.

2

"COPPRALYTE" *Copper Plating Salt*
SODIUM FORMULATION

- High purity, readily soluble salt for sodium-type copper plating bath.
- Provides maximum economy of operation.
- Permits easier make-up and maintenance.

3

"COPPRALYTE"
ADDITION AGENT 1085

- New and improved, *free-rinsing* anti-pit agent.
- Effective in all types of installations.

Tune in to Du Pont "CAVALCADE OF AMERICA"
Tuesday Nights—NBC coast to coast

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on "Coppralyte" Copper Plating Chemicals and other Du Pont chemicals, processes and services for electroplating, ask your Du Pont technical representative, or call or write our nearest office. E. I. du Pont de Nemours & Co. (Inc.), Electrochemicals Dept., Wilmington 98, Delaware.

DISTRICT SALES OFFICES: Baltimore, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, El Monte (Calif.), New York, Philadelphia, Pittsburgh, San Francisco.

DU PONT *Chemicals • Processes • Service*
for ELECTROPLATING

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING ... THROUGH CHEMISTRY

Personals

with Detroit Chemical Specialties, Inc., Detroit, Mich. Mr. Blake, who has over eight years' plating experience, received his technical training at General Motors Tech and Ohio State College.

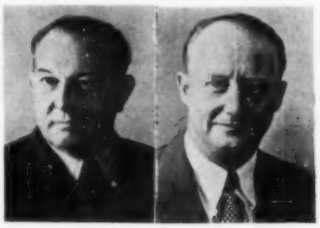
Francis E. Murphy has been appointed Production Supervisor of the Wyandotte works of the Pennsylvania Salt Manufacturing Company. He joined Pennsalt in 1943 as Assistant to the Manager of Research and Development. In 1945 he was transferred to Pennsalt's Whitemarsh Research Laboratories as Director of Development and in 1947 came into the Manufacturing Division as Assistant Production Manager. Later he became Supervisor of Process Controls. He is a graduate of St. Joseph's College, Philadelphia.

Charles N. Chalfant is now Industrial Service Representative in the metropolitan New Jersey area for Optimus Detergents Company, Matawan, N. J. He

Chalfant

comes to Optimus from Wyandotte Chemicals Corporation, where he was sales and service engineer in the southwestern Ohio territory. Prior to that, he was Detroit service representative of G. Whitfield Richards and a member of the chemical and metallurgical laboratory staff of the Copperweld Steel Company. He studied chemistry and metallurgy at Carnegie Tech and University of Pittsburgh.

John A. Decker is now Sales Manager for the New York District of The Carborundum Company, and **William J. Kingsley** is assistant Sales Manager of



Decker **Kingsley**

the Bonded Products and Grain Division with headquarters in Niagara Falls, N. Y. Mr. Decker, with the Company since 1933, held the position of Assistant Sales Manager of the New York District prior to his present appointment. Mr. Kingsley, a veteran of twenty-eight years' service with Carborundum, was previously a salesman working out of Syracuse, N. Y., and Boston, Mass.

Other changes announced by the Company provide for the transfer of **Thomas Curtiss**, a field sales representative in the Buffalo District, to the Central New York area. **Edgar T. Harris** will fill the Buffalo District Office vacancy. **George Dennison**, formerly industrial salesman, was named a special sales engineering representative for the New York State with headquarters in the Buffalo District Office.

James F. Stomber has been appointed administrative assistant of Hanson-Van Winkle-Munning Company, Matawan, N. J., and has been assigned financial and

Stomber

statistical duties. He received his B.S. degree from New York University in 1943, majoring in foreign trade and marketing. From then until 1946, Mr. Stomber served in the Navy as a lieutenant. From 1946 until he joined Hanson-Van Winkle-Munning, his educational background on investments was used to good advantage as assistant to the Vice-President and Comptroller of Lee Higginson Corporation.

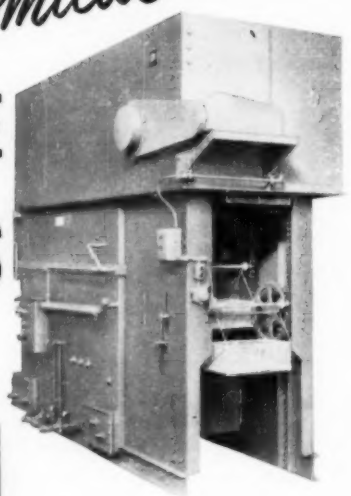
Economical

BLAKESLEE

SOLVENT VAPOR

DEGREASERS

USE LESS SOLVENT



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Stabilized Degreasing Solvent — one price, one solvent *for all metals*

NIAGARA

Metal Parts Washers for use with cleaning compounds on either batch or production jobs.

Blakeslee Solvent Vapor Degreasers USE LESS SOLVENT because of the patented construction and operational features. Metal parts are made chemically clean and dry in just a few seconds. Save time, labor, rejects with a Blakeslee Solvent Vapor Degreaser. A Blakeslee engineer-trained representative is available to solve your specific degreasing problems.

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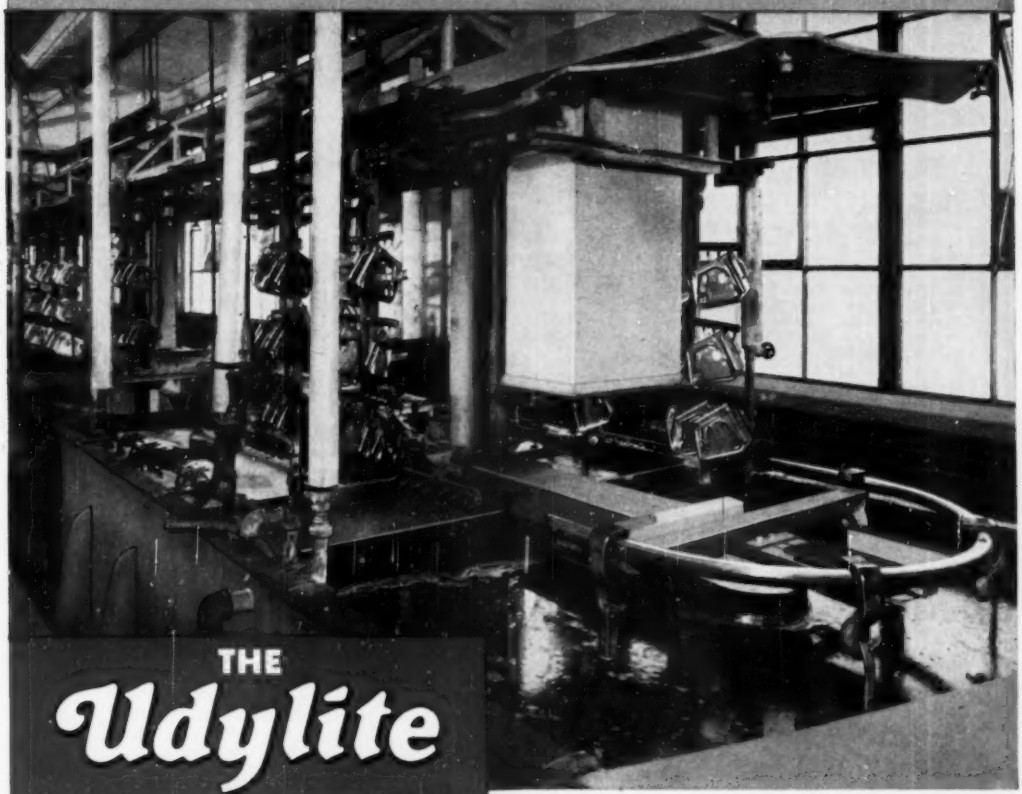
New York, N. Y. Toronto, Ont.

5 days FROM FACTORY TO FULL OPERATION FOR THIS Udylite FULL AUTOMATIC

That's right. This Udylite Full Automatic Plating Machine at Howard Plating Industries, Inc., Detroit jobber, was shipped on Thursday and in full operation the following Tuesday. This rapid installation is a matter of course with Udylite. For Udylite Full Automatics are completely assembled at the factory—ready to run at the turn of a switch. Installation is merely a matter of moving in the equipment—hooking it up and filling the tanks with solution. Naturally, this feature pays off with lower installation expense and a minimum of lost production time.

There are many other advantages to Udylite equipment, too. Horace Jones, plating superintendent of Howard Plating Industries, reports: *"Our new Udylite Full Automatic has been operating 18 hours a day, six days a week, for over a year. It's a 100% jobbing operation, zinc plating everything from jet engine parts to dime store novelties. We've spent nothing on repairs and very, very little on maintenance. Production is up 25% and we've cut labor costs in half. Believe me, we're really sold on Udylite."*

Udylite Plating equipment can bring many advantages to *your* plating operations. Call in your Udylite Technical Man today, let him analyze your problems and show you the way to more profits in plating—or write us direct.



THE Udylite CORPORATION
DETROIT 11, MICHIGAN

PIONEER OF A BETTER WAY IN PLATING

AVAILABLE FOR IMMEDIATE SHIPMENT ATTRACTIVE VALUES

THE FOLLOWING EXCELLENT REBUILT AND GUARANTEED ELECTROPLATING MOTOR GENERATOR SETS AND RECTIFIERS, WITH FULL CONTROL EQUIPMENT:

1—15,000/7500 AMPERE, 6/12 VOLT, **COLUMBIA ELECTRIC CO.**, Separate M. G. Exciter.

1—10,000/5000 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING CO.** Separately Excited. Synchronous Motor. Excellent Condition.

1—5000/2500 AMPERE, 6/12 VOLT, **EAGER.** Separately Excited. Excellent Condition.

1—3000/1500 AMPERE, 12/24 VOLT, **HANSON-VAN WINKLE-MUNNING CO.** Synchronous Motor. Exciter-in-Head. Excellent Condition.

1—3000/1500 AMPERE, 6/12 VOLT, **ELECTRIC PRODUCTS CO.** Synchronous Motor. Separately Excited.

1—2000/1000 AMPERE, 12/24 VOLT, **HANSON-VAN WINKLE-MUNNING.** Separately Excited.

1—1500/750 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING.** Shunt Wound. Separately Excited.

2—1000/500 AMPERE, 6/12 VOLT, **CHARLES J. BOGUE.** Separately Excited. Interpole Design. Exciter-in-Head.

1—750 AMPERE, 12 VOLT, **CHANDEYSSON ELECTRIC CO.** Synchronous Motor. Exciter-in-Head.

1—1500 AMPERE, 40 VOLT, **HANSON-VAN WINKLE-MUNNING.** Anodizing Synchronous MG Set. Automatic Controls. Exciter-in-Head.

1—1000 AMPERE, 40 VOLT, **HANSON-VAN WINKLE-MUNNING CO.** Anodizing Synchronous M. G. Set. Exciter-in-Head.

2—500 AMPERE, 40 VOLT, **"M. G. C."** Anodizing M. G. Set. Exciter-in-Head.

1—400 AMPERE, 40 VOLT, **"M. G. C."** Anodizing M. G. Set. Exciter-in-Head.

1—1000 AMPERE, 25 VOLT, **HANSON-VAN WINKLE-MUNNING CO.** Separately Excited. Anodizing Unit.

MANY OTHER SIZES IN STOCK.

5—**GREEN** SELECTROPLATERS, 1800 AMPERES, 12 VOLTS, for operation on 220/3/60.

4—**G. E.** COPPER OXIDE RECTIFIERS, 500 AMPERE, 6 VOLT, for operation on 220/3/60.

3—**HANSON-VAN WINKLE-MUNNING** COPPER OXIDE RECTIFIERS, 500 AMPERES, 6 VOLTS, with 220/440 volt, 3 phase, 60 cycle input.

SPECIAL

1—12,000 6000 AMPERE, 12 24 VOLT, BRAND NEW COLUMBIA. Separately Excited. Synchronous Motor. Complete Controls.

PRICED RIGHT IMMEDIATE SHIPMENT

M. E. BAKER CO.

25 WHEELER STREET
CAMBRIDGE, MASS.

Trade Literature

L—497. Zinc Bright Dip—Impressive savings with brighter appearance and greater reliability of results are among the benefits claimed by the Chemical Corporation, Springfield, Mass., for its new Luster-On Utility-15 Zinc Bright Dip. Other advantages are set forth in a 6-page folder, which also discusses in some detail the procedures used and control method.

Sample parts sent will be processed free of charge. For your copy, use Reader Service Card.

L—498. Touch-up Zinc Phosphate Coating—American Chemical Paint Company, Ambler, Pa., offers a 2-page sheet which describes the Touch-up Granodine Process for the application of a zinc phosphate coating to old or new work prior to painting. It is applied by spraying or brushing, and is available in quart or gallon bottles. Directions and equipment notes are included. For your copy, use Reader Service Card.

L—499. Story of Aluminum—The many uses for aluminum are described in simple nontechnical language in the new book, "The A-B-C's of Aluminum", published by Reynolds Metals Company, 2500 S. Third Street, Louisville 1, Ky. The text is divided into three principal sections: "A" for Alloys, their production and fabrication; "B" for Benefits, the many natural advantages of aluminum and how they serve; and "C" for Consumption, the many new uses for aluminum today and its potentials for tomorrow.

A series of 69 pictures and charts presents a pictorial story of how aluminum is produced from raw ore, made into metallic aluminum, and then processed to form sheet, rod, bar, and other aluminum mill products. In addition, pictures of such typical fabricating operations as welding and forming are included. It is sent without charge to anyone in the metalworking industry requesting it on company letterhead and mentioning PLATING.

L—500. Plant Lighting—A 32-page "Planning Guide to Improved Plant Lighting", covering the latest concepts of planned lighting, the benefits to be gained, and the methods to employ, is published by Benjamin Electric Manufacturing Company, Des Plaines, Ill. The subject is covered from management viewpoint and divided into: Economics, Program Development, and Equipment Selection. For your copy, use Reader Service Card.

L—501. Prepaint Cleaner—How a new prepaint metal-cleaning material, Oakite Compound No. 33, performs three jobs in one operation is discussed in a 6-page folder issued by Oakite Products, Inc., 140 Thames Street, New York 6, N. Y. Used in tanks or by hand, the compound is said to (1) have solvent and detergent properties that are effective in removing stamping and forming oils, rust preventives, carbon smuts, soldering and welding fluxes, identification inks, and similar soils; (2) contain acid ingredients that act on rust, heat scale, tarnish and other oxides, as well as special accelerating agents that make the removal of rust a fast operation; (3) microscopically etch steel and cast iron and convert the surface layer of metal into a thin film of insoluble phosphates to assure adhesion of paint to metal. The etching and conditioning action of this material on aluminum sheet and aluminum castings is similar, the folder states. For your copy, use Reader Service Card.

L—502. Anode Scrap Saver Baskets—Automotive Rubber Company, Inc., 8601 Epworth Boulevard, Detroit 4, Mich., has issued a Bulletin No. 100 describing its rubber-insulated anode baskets, complete with duck filter bags, for conservation of anode supplies. Use of sturdy construction and cutting-resistant semi-hard rubber is featured. For your copy, use Reader Service Card.

L—503. Finish-Bonding Material—The Michigan Chrome & Chemical Company, 6340 E. Jefferson Avenue, Detroit 7, Mich., announces Microloid Primer, a new bonding material for all metal finishes. Quick drying and flexible, it is said to (1) provide maximum adhesion to brass, bronze, tin, lead, galvanized metal, zinc, steel, cadmium, magnesium, and aluminum; (2) act as a rust inhibitor, forming insoluble phosphates at the metal surface which prevent corrosion from creeping beneath the paint film; (3) serve as a prime coat to provide temporary protection for metals before painting. It can be applied by spraying, dipping, or brushing. For detailed bulletin giving complete information and instructions for application, use Reader Service Card.

L—504. Abrasion Tester—A 6-page Bulletin 5003 describing a new Model 140 Taber Abraser has been published by Taber Instrument Corporation, 111-PL Goundry Street, North Tonawanda, N. Y. It illustrates how the tests are performed and the action on a number of materials and lists the items which make up a complete set. For your copy, use Reader Service Card.

L—505. Self-priming Pump—Complete information on a new line of self-priming centrifugal pumps is now available from Goulds Pumps, Inc., Seneca Falls, N. Y., in an 8-page illustrated Bulletin 636.1.

The pumps are of a new design that

When Finish is Important...
Specify ALUNDUM Polishing Abrasive
. . . the abrasive that will do the job quickly and economically.
• For fast cut on roughing operations—specify S-Treated ALUNDUM abrasive
• For a general purpose abrasive for roughing or finishing, where long life is of primary importance, and for jobs where the wheel is set-up with cement—specify B-Treated ALUNDUM abrasive
• For finishing operations, where glue is used as the adhesive—specify R-Treated ALUNDUM abrasive
For full details on ALUNDUM Polishing Abrasive, and many helpful polishing tips, write for your free copy of "Setting-Up Metal Polishing Wheels and Belts."
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ABRASIVES
Making better products to make other products better

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if you want to save

Chromic Acid

Chromic Acid solutions, which have been rendered useless by dissolved metals, may be purified for re-use by treatment with oxidation-resistant cation exchange resins. Based on a preliminary investigation by Mutual Chemical Company of America, this method offers an answer to many problems of chromium waste disposal. Recovery of chromic acid, with possible recovery of metals or metal salts, points toward cost savings in a variety of metal treating processes such as anodizing, copper stripping, brass pickling and chromium plating.

Write today for a copy of "Regeneration of Chromic Acid Solutions by Cation Exchange" Mutual's Serial No. 65.

MUTUAL CHEMICAL CO. OF AMERICA — SINCE 1845

MUTUAL CHEMICAL CO OF AMERICA

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USE OUR Technical Consulting Service

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Twenty-Seven Years of Service — Quality — Price

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For Free Technical Consulting Service, pertaining to Polishing and Buffing

Write for complete information

A Complete Line of Compounds Tailor-made to suit your particular requirements.

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Trade Literature

eliminates valves and yet gives efficiency comparable to standard centrifugal pumps. They are made in sizes ranging from ¼ to 5 hp with both open and closed impellers. Capacities range up to 120 gpm and heads up to 135 feet depending upon capacity. They can handle suction lifts up to 25 feet. For your copy, use Reader's Service Card.

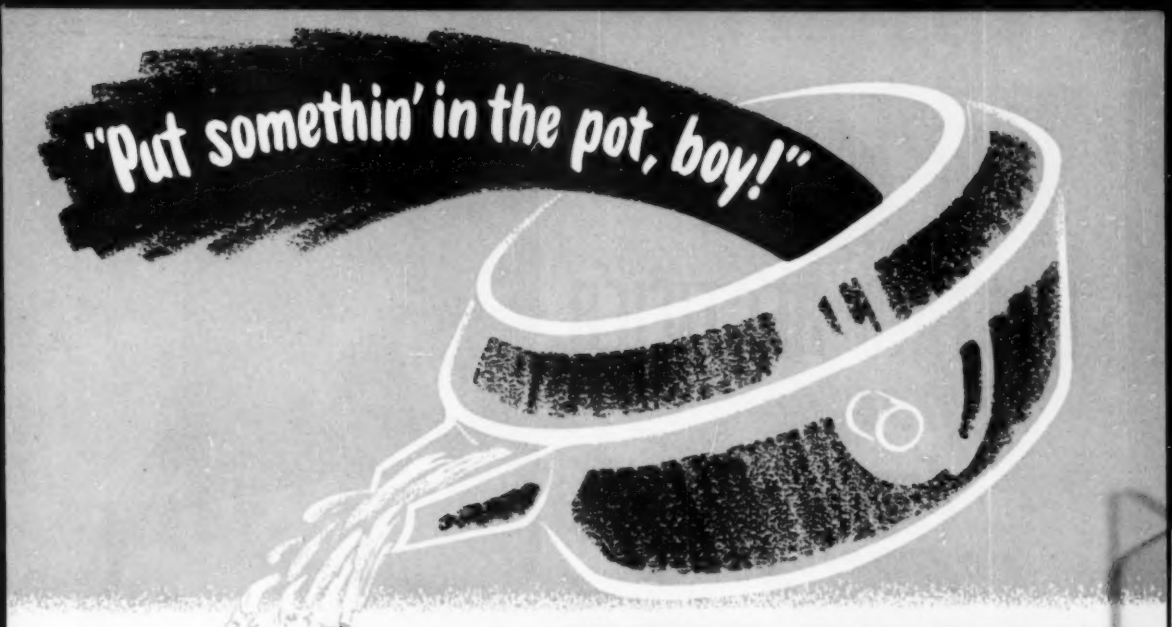
L—506. Portable Hardness Tester—A portable direct-reading Ernst Hardness Tester, 6 inches high by 2½ inches in diameter, is now distributed by Newage International, Inc., 521 Fifth Avenue, New York, N. Y., and described in Bulletin ET-139.

In use, hand-grips on the side of the instrument are pressed downwards to make the indentor point penetrate the surface of the material being tested under the action of a carefully calibrated helical spring exerting a constant load of 15½ lbs. The movement of the indentor into the material is magnified about 3,000 times to indicate the hardness value directly in Rockwell, or if required, Brinell, Diamond Pyramid, or tons tensile. High range of standard instruments is 25–65 Rc; medium range, 35–75 Rockwell A or 100–440 Brinell; low range, 50–260 Brinell. The load and application is very similar to Diamond Pyramid machines. For your copy, use Reader Service Card.

L—507. Gas Mask—A full-vision gas-mask face piece which provides connections to chin-style, chest-style and hose-

mask canisters in one unit has been announced by Acme Protection Equipment Company, 3037 W. Lake Street, Chicago 12, Ill. According to a 4-page illustrated Bulletin 504, the face piece includes a dead-air check and a new type of inhalation-exhalation valve for minimum breathing resistance. For your copy, use Reader Service Card.

L—508. Ball Burnishing—A new development in equipment for wet ball burnishing and polishing—the completely



. . . and get NEW ANODES from YOUR NICKEL SCRAP

You can *beat* the nickel famine!

Dig into that nickel mine in your scrap bins. Send us those ends, swords, stubs -- any nickel anode scrap. We'll cast *your own metal* into *new* oval anodes, drill and tap for hooks and ship to you pronto. You paid for this metal; why not use it? It represents a reliable source of nickel at this time and the cost of re-conversion is low. Wagner Brothers, Inc., has installed the finest melting and casting equipment available and your metal is processed under stringent metallurgical control. We're centrally located, easily reached at low transportation cost.

To handle a large volume of metal efficiently, we recommend a standard ordering and shipping procedure. Just fill out the coupon in detail and we'll send full directions for packing and shipping, and quote on any quantity.

Wagner BROTHERS INC.

425 MIDLAND • DETROIT 3, MICH.

We have electrolytic nickel anode scrap for re-conversion.

Stubs, average length _____ inches
Weight (less hooks) _____ pounds

Swords, average length _____ inches
Weight (less hooks) _____ pounds

Shipment can be handled in

☐ Strapped bundles ☐ By Rail
☐ Drums ☐ By Truck

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

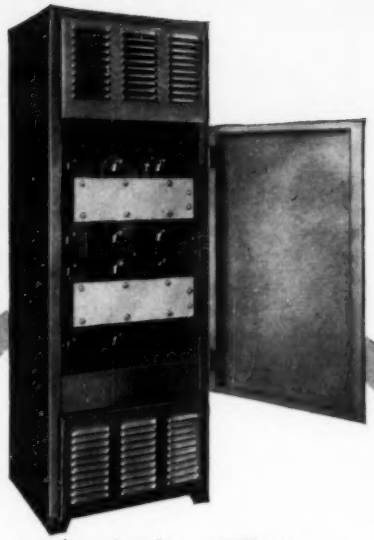
NEW

PLATING RECTIFIER

Protected from corrosive atmosphere

The first plating rectifier with oil-immersed selenium stacks

Put this new plating rectifier right where you need it—next to your plating tank. Get the money-saving advantage of tank-side location—low electrical losses of short connections—and still get full life expectancy from your rectifier. Only General Electric offers you such a rectifier. For only General Electric has an oil-immersed selenium rectifier stack designed specifically for plating work.



Check these Features

Oil-immersed Selenium Stacks—These rectifier stacks are hermetically sealed in welded, oil-filled cans. They are completely protected from plating-room atmosphere.

Ventilation—Fan blows downward over rectifier stacks and transformer. Air flow is not disrupted when inspection door is open.

Overload Capacity—Improved ventilation and thermal capacity of the large mass of oil in intimate contact with entire rectifier cell surface means this rectifier can safely handle short-time current overloads. It's ideal for barrel plating.

Dual Output Rating—By a simple bus-bar connection, you can obtain either 6 volts–1500 amps or 12 volts–750 amps from the same rectifier.

Dual Input Rating—This unit can be connected to operate from 230 volt circuits or from 460 volts. Taps are provided to correct for line-voltage variations.

Casing Design—Steel baffles protect operator from high-voltage connections when inspection door is open. To complete the corrosion resistance of this unit, all casing parts are phosphatized, then sprayed with an attractive hammertone finish.

Get the complete details.
Write Section 464-4. Apparatus Dept., General Electric Co., Schenectady 5, N. Y.

GENERAL ELECTRIC

464-4

IMPROVED

and superior by every standard of comparison . . . and costs less!

MICCROSOL

E-1003

HEAT-CURED RACK COATING

● Now, the Michigan Chrome and Chemical Company laboratories have improved their single-dip heat-cured rack coating which offers, in addition to positive insulation and protection: (1) amazing tensile strength and scuff resistance; (2) permanent flexibility; (3) positive and continuous adhesion; (4) simplicity of application; (5) savings in time, labor, and material . . . a major objective of chemical engineers for years.

● Exhaustive tests reveal the marked superiority of Improved MICCROSOL E-1003 in every important manner of comparison. In addition to the outstanding characteristics listed above, tests for abrasion and resistance to all commonly used plating solutions, acids, and caustics show superior performance in comparison to similar products.

● Improved MICCROSOL E-1003 is a 100% solids non-evaporating material that produces a smooth, tough, leather-like coating with a single application which will often outlast the life of the rack. Racks are completely processed and ready for use in approximately 2 to 4 hours.

● Has exceptionally high gloss, allowing free drainage and no solution carry-over.

● If you are not prepared to coat your racks, write us and we will be glad to furnish the name of the applicator nearest you who is equipped to apply Improved MICCROSOL E-1003 Heat-Cured Rack Coating.

It's Improved in Every Respect!

Write for detailed bulletin.

MICHIGAN CHROME
and Chemical Company
6351 East Jefferson Avenue • Detroit 7, Michigan

MICCRO Products

Developed and Manufactured by

Trade Literature

automatic Tumb-L-Dur Burnishing machine—is covered in a Bulletin TDB-60 issued by Lupomatic Industries, Inc., 4510 Bullard Avenue, New York 66, N. Y.

Most important feature is the molded Tumb-L-Dur barrel, made from a material that gives exceptionally long life. The same service that can wear out a wooden barrel in 3½–4 weeks has not affected a Tumb-L-Dur barrel in use for more than 1½ years. Another important advantage is Tumb-L-Dur's extra strength, whereby thinner barrel walls can be used, resulting in increased capacity.

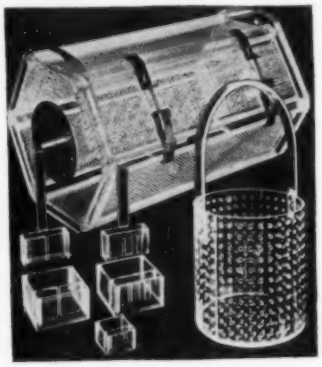
The bulletin contains complete specifications for the standard UP line, which may also be equipped with fabricated Tumb-L-Dur barrels. Model numbers, tumbler sizes, and capacities are given. For your copy, use Reader Service Card.

L—509. Plating Racks—National Rack Company, 396 River Street, Paterson, N. J., and Imperial Plating Rack Company have issued a 12-page pictorial

catalog which illustrates their engineering and manufacturing facilities for manufacture of racks from one foot to 112 inches long.

Also illustrated are two features: the replacement-tip assembly and the 100 per cent solids insulation that will withstand a normal degreasing cycle. Those interested in obtaining the story of Narco's facilities may use the Reader Service Card.

L—510. "Lucite" Equipment—Bulletin G-1 dealing with Boilable or "High-Temperature" Lucite equipment for electroplating and chemical processing has been issued by Singleton Company, 10516 Western Avenue, Cleveland 11, Ohio.



In four years, since the first Singleton Fusion-Welded H-T Lucite Tank was introduced, several thousand units of this equipment have been built for and are used by over 600 firms, including many of the largest in the field. Among features listed are (1) resistance to all acids, alkalies, and "hot" solutions up to 220° F; (2) interchangeability of baths without contamination; (3) thermal and electrical insulation—no loss of current; (4) machineable; (5) 11 per cent clearer than glass—see baths in action; (6) high impact strength and modulous of elasticity; (7) exclusive Singleton Fusion-Welded no-leak seams with tensile strength to 10,000 psi; (8) lightweight; (9) low cost.

The bulletin pictures the firm's complete line of plating-range cells, laboratory and production tanks, liners, baskets, buckets, trays, and plating cylinders. For your copy, use Reader Service Card.

L—511. Wood Tanks and Pipe—Santa Fe Tank & Tower Company, 5401 S. Boyle Avenue, Los Angeles 11, Calif., and principal cities, offers a 6-page illustrated Bulletin P-94 which describes its wood tanks (with or without stainless-steel, lead or plastic linings), wood stacks and pipe, as well as cooling towers. For your copy, use Reader Service Card.

L—512. Protective White Enamel—Prufcoat Laboratories, Inc., 63 Main Street, Cambridge, Mass., has issued a 4-page catalogue describing its BX White Enamel, said to be extremely white and equal to colored Prufcoat enamels in protective ability for metal, wood and ma-

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L—513. Baking Finishes—A booklet describing the line of Duranite clear and pigmented synthetic baking finishes has been issued by the Industrial Finishes Department of the Atlas Powder Company, Stamford, Conn., and North Chicago, Ill. The booklet also includes data on Duranites for controlled temperature application (CTS). For your copy, use Reader Service Card.

L—514. Water Conditioner—The new Cochrane Water Conditioner, manufactured by Cochrane Corporation, 3152 N. 17th Street, Philadelphia 32, Pa., which combines advantages of both hot-process and zeolite softening, is described in a bulletin just released. This conditioner is a two-state softener in which first stage is hot process, using lime or Dolomitic lime, followed by the zeolite softener, which reduces residual hardness to zero. Its use is said to make for marked savings in capital investment, chemicals, floor space, and head room, as well as operating attention. For your copy, use Reader Service Card.

L—515. pH Electrodes—The complete line of Leeds & Northrup *p*H electrodes and assemblies for both industrial and laboratory applications is now presented for the first time in a 24-page catalog, "L & N *p*H Electrodes, Assemblies, Parts and Accessories".

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L—516. Viscosimeter—A brochure describing the Synchro-lectric Viscometer manufactured by Brookfield Engineering Laboratories, Inc., Stoughton, Mass., is just off the presses. This standard instrument is used in the laboratory and at the point of process to test, study and control viscosity. It reads directly in centipoises and is said to offer a number of exclusive features which provide for long-life accuracy. For your copy, use Reader Service Card.

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Subject: Porosity Research

DEAR SIR:

The report by Dr. Thon and his colleagues on the A. E. S. Porosity Research in the July issue of PLATING contains several references to work published by us 12 years ago and seems to call for comment.

The authors state that the outcome of their work so far "involves a fundamental departure from the older views" which postulate that local failures by corrosion of nickel plated articles are primarily the result of discontinuities present in the coating when it is removed from the plating bath. The authors have shown that pores develop in the coating when it is exposed to certain corrosive conditions. This is a significant discovery, but unless they are suggesting that discontinuities are not present in freshly plated coatings, it would seem to be more correct to state that their results provide a fundamental extension of the older views.

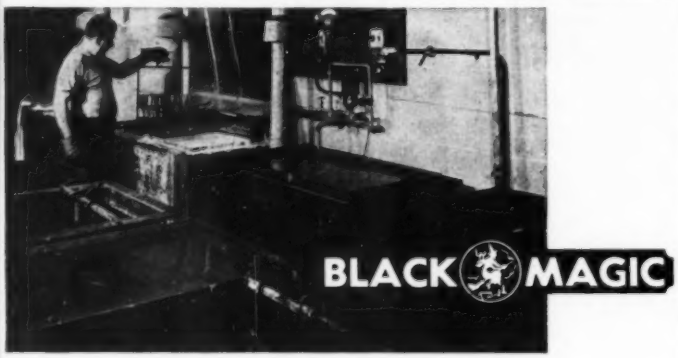
We do not recall any evidence in Dr. Thon's published work which would encourage the belief that there is any escape from the risk of discontinuities being present in commercially plated coatings. So long as electroplaters are obliged to use solutions which become contaminated with suspended particles and so long as they have to plate metals containing surface imperfections, they are not likely to be able to avoid the production of discontinuous coatings in thinly plated areas, although means may well be developed for reducing this type of defect to small proportions. Our work, which was interrupted by the war and has not been resumed, was directed to finding the precise causes of these elementary pores with a view to revealing practical methods for their reduction. Even if we had been able successfully to complete this task, we should presumably still have been faced with the problem, thrown into relief by Dr. Thon, of the production of pores on exposure to corrosive conditions, but we regard this as a different question, requiring a different method of approach. Dr. Thon's most interesting and valuable work is throwing a new light on this second problem and is providing new information of fundamental importance, but we do not think that he should assume that the old problem is any less important than it was; we believe it to be of first class practical importance and its solution to involve basic work in both metallurgy and electrochemistry.

Dr. Thon's work has emphasized the importance of finding a test, preferably a simple one of the chemical type, which would distinguish between pores existing in freshly plated coatings and those which develop on standing or as a result of corrosion. We are aware that none of the conventional tests which we have used are free from the objection that the number of pores revealed increases with the duration of the test; we selected the hot water test in the belief that, when carefully used, it was less open to this objection than others which we had tried. Incidentally, we found after our work had been published that the hot water test was sensitive to the presence of fumes in the atmosphere; for example, more pores were revealed when the water was heated by gas than by electricity.

We should like to take this opportunity of correcting a misleading impression about our results which is given in Dr. Thon's report in the July issue of PLATING. Our method of producing thin nickel coatings free from elementary pores was to combine the use of solutions free from suspended matter (secured by special filtration of the bath and platinum anodes contained in fine-grade Alundum pots) with iron or steel cathodes having a favorable surface; our work did not proceed far enough to allow us to define fully the nature of surface imperfections which would cause porosity, but we found amongst other things that electrolytic iron sheet prepared by annealing and rolling a thick piece of electrolytic iron and finely machined cold-rolled steel bars provided a good surface. We did not, however, find that a thin coating of electrolytic iron on an unsuitable steel surface lessened appreciably the tendency to pore formation in nickel coatings, and we do not understand how this statement came to be associated with our work. Furthermore, nearly all of our cathodes were etched before plating, so that we usually deposited upon a "crystalline surface".

We should like to conclude by paying tribute to the excellent work on porosity which is being carried out for the A. E. S. under Dr. Thon's direction and to express our interest in its future development.

A. W. HOTHERSALL, R. A. F. HAMMOND
London, England



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DEAR SIR:

We are thankful to our British colleagues for their comments and welcome the opportunity to stress a few points. We do not deny the existence of discontinuities in electrodeposits prior to corrosive exposure, on the contrary we think we have demonstrated a systematic fine pososity which causes measurable gas permeability in sufficiently thin electrolytic foils. Neither do we deny the occurrence of gross defects—we call them, more simply, holes—which, although sporadic, seem to be unavoidable over large areas, and the more so the thinner the foil. What we do deny is that chemical reagents, such as the various ferroxyls or hot water, can be taken to demonstrate original presence of such gross discontinuities, let alone count them. The so-called "porosity reagents" are actually corrodents, strongly suspect of producing holes depending on conditions of their application, while on the other hand there is no assurance whatever of their revealing all or a determinable fraction of actually existing holes. Our own test for the occasional occurrence of holes, and the only one that convinces us, is inspection in transmittance, without or with magnification, of thin electrodeposited foils, stripped from their base by means safe enough to satisfy us that they produce no new holes. It is such visual inspections, not chemical tests, which have proved to us that gross holes are quite likely to occur here and there, and will unavoidably occur if a sufficiently large area is examined. That is also the only way we know of to count the holes reliably. Such counts have further convinced us of the utter capriciousness of the occurrence and, particularly, the *distribution* of such accidental gross defects. That they need not necessarily occur is demonstrated by the fact that, except in thinnest foils, one can always find macroscopically wide areas completely free from visible perforations, while other areas may be unusually bad. The question, why then is it that there always will be at least a certain number of holes over, say, a square foot, can be answered much in the same way as the question, why it is that there always will be a few accidents in a group of 100,000 drivers. Even though gross discontinuities are essentially a matter of accident, they are governed by statistics, and their numbers can probably be predicted much in the same way as we can predict with fair approximation the total number of traffic deaths over the coming Labor Day.

With regard to the causes of such accidental holes, the work of Hothersall and Hammond is a classic, and there is not much to be added to it. Nor will anybody deny that, if a cathodic protective coating is locally defective, corrosion will take place at that point without delay. But the school of thought which we have termed the "old view" went far beyond that. In the old view, all failure of electrolytically coated iron, early or late, sporadic or evenly distributed, was attributable to initially present holes ("porosity" in the old usage). This we consider to be a gross misconception, and one which has no basis in fact; it was the result of the hypnotism exerted by the "porosity" determinations using chemical reagents and of the erroneous interpretation given to such *corrodibility* (not "porosity") tests.

Our new view shifts the emphasis from the accidental, and at least partly avoidable, to what is systematic and unavoidable, namely, attack of the base owing to progressive depth corrosion of the coating. *That* problem, and the search for ever better depth-corrosion-resistant coatings, will be always with us and is *by far* the salient one. Whether the new view, which rejects both the old-view demonstration and the count of initially present holes with the aid of reagents and which attributes long-range failure to pores developed through exposure, amounts, as we think it does, to a radical overthrow of the old initial-porosity tenet or is merely, as our colleagues prefer to have it, a "fundamental extension" of the older views, is largely a matter of literary taste, and we attach no importance to it.

Our regrettable misquotation of the findings of H. and H. does not seem all too serious to me. It only shifted to them some of the credit due to us. Of the two essential factors which enabled them to produce thin hot-water-negative nickel, freedom from suspended matter seems to have played no role in our experiments, which means that all our baths were equally satisfactory in that respect. The authors' use of electrolytic iron as base prompted us to try a thin intermediate electrolytic iron layer over rolled iron, with the reported beneficial results. What we emphasize is, once more, that the hot-water negativity of such deposits means lesser corrodibility, not "initial

(*Continued on page 1080*)

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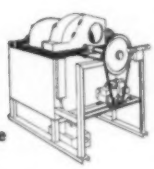

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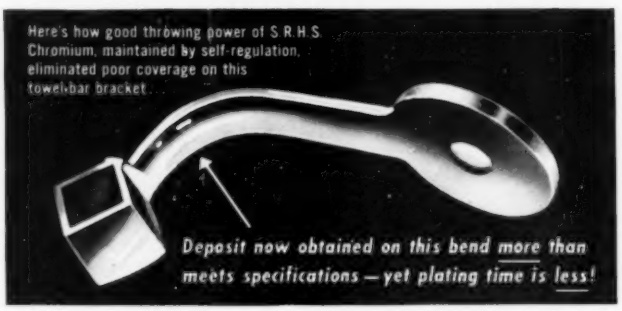
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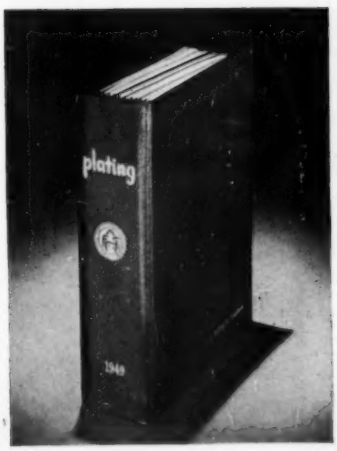

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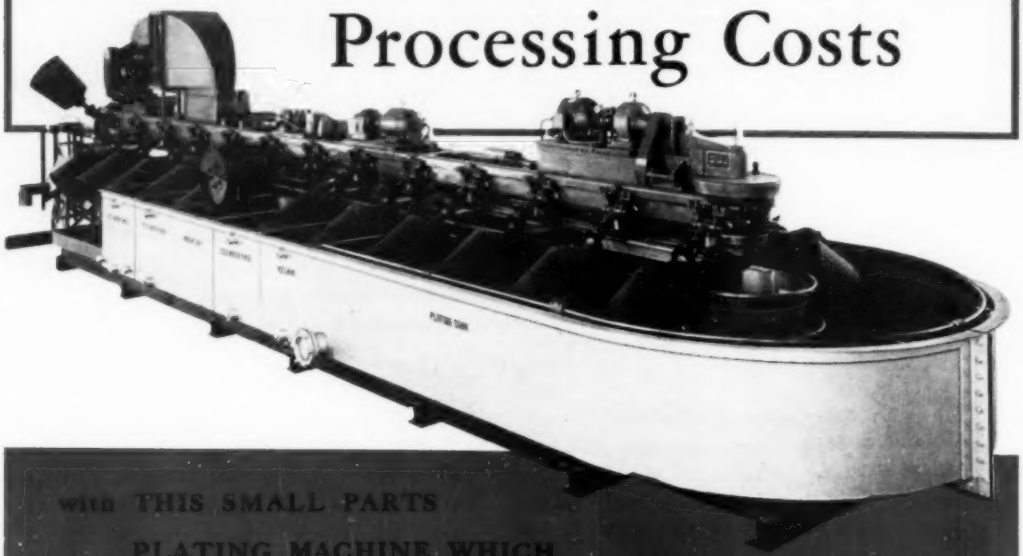

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plating

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Editorial

Nickel Conservation

THE OTHER DAY, when he came to town, I had the pleasure of lunching with Clyde Kelly at one of my favorite luncheon spots, the Empire Room of the Fort Shelby Hotel. There, to gentle strains of soft, canned music, we talked of various things—the Tigers' chances of winning the American League pennant, the National Finishing Exhibit to be held in Chicago during the 1952 Annual Convention—for which venture Clyde serves as chairman—the war in Korea. And because, among other things, he was in Detroit to seek nickel anodes for his company, Driscoll, Inc., of Chicago, it was inevitable that our conversation should turn to this lively topic.

Said Clyde, "It is always worthwile to avoid wasting nickel; it is never cheap. But now, when again nickel anodes are hard to get, we have an additional reason for conserving. On the twenty-fifth of August," he continued, "the Chicago Branch is holding a special meeting to consider round table style ways and means for making the available supply go as far as possible; much can be done without sacrifice in quality."

Then we went on to enumerate some of the ways in which nickel can be saved:

1. In most installations, rubber or plastisol coated anode baskets, available from a number of sources, may be used to bring about complete corrosion of even the smallest anode stubs and remainders. Electrical contact to the small anode pieces piled into the anode baskets is usually made through contact with one or more new (or fairly new) anodes suspended from the anode bar, so that they hang in, but toward the back of, the basket. Since, under these conditions, one anode hook may be called upon to carry more than the usual amount of current, it is often desirable, for good electrical contact, to bolt it to the anode bar. Sometimes the hood is omitted altogether; instead the anode itself, with a suitable machined contacting surface, is fastened to the anode bar.
2. Use only covered plating racks and keep them in good repair; nickel plated on racks or wires is a nuisance as well as a waste.
3. Look carefully to rack design. Often some parts or part areas are grossly overplated in order to build up specification plate on other parts or areas.
4. Similarly, if anode distribution within a given tank is not uniform, some racks may overplate while others in the same tank load, starved for current, struggle toward specification thickness.
5. Avoid overplating. While all authorities do not agree, most specifications for plated steel and zinc-base parts provide that a portion of the total plate thickness required may be of copper. Since copper, at least for the present, is fairly available, this is worth consideration.
6. More than ever, strive to reduce losses due to defective plating. Assume for the moment a monthly nickel-anode usage of 8,000 pounds. If losses due to defective plate—and other causes such as careless handling, improper wheel work—amounts to as much as five per cent, then 400 pounds of nickel must be considered lost, whether parts be stripped or simply replated.
7. While dragout losses are made up by additions of nickel salts rather than through corrosion of anodes, it is desirable more than ever to use still or "save" rinses. Particularly in barrel plating, it is possible to lose a great deal of plating solution as dragout, and the pinch may affect nickel sulfate and nickel chloride as well as nickel anodes.

"We all expect to learn something at our meeting coming up on the twenty-fifth," said Clyde as he finished his coffee and I brushed the crumbs off my lap. "It's a timely subject for other Branches to talk over, too."

C. J. Nixon

DUCTILE, MIRROR-BRIGHT COPPER PLATE FROM ACID SULFATE BATHS

Part I. Initial Research and Brightener Preparation

C. J. SLUNDER*, A. E. BEARSE*, and C. L. FAUST*

Introduction

A research program with the objective of reducing finishing costs for bumper bars included the development of a bright-copper plating bath from which the plate is ductile. The use of the acid copper sulfate electroplating process for over a century testifies to its dependability. It possesses the advantages of simplicity, ease of operation, ease of maintenance, a relatively high cathode efficiency, and a high limiting current density and permits deposition of a uniform, adherent, mat plate.

In many places where the acid sulfate copper bath is used, it is desired to have a bright, smooth, and ductile coating, either as the final product or as a base for further deposition of other bright metals. Heretofore, brightness of copper plate from the acid sulfate bath has been realized only by buffing and coloring. For reasons of efficiency and economy in finishing, there was need for a bright-copper plating process having the advantages of the acid sulfate bath and producing a smooth, ductile coating possessing "hiding" power in one operation. Attempts have been made from time to time without complete success to develop an acid copper plating bath having the above properties.

Notable among these attempts was the use of thiouren and molasses as brightening agents, as described by Clifton and Phillips[1]. Although bright plates were depositable, there were shortcomings in properties and in operation control.

The Henricks patent[2] specifies the use of the sulfonation products of sulfurized aromatic compounds in the acid copper sulfate bath for plating mirrorlike, ductile copper. The brighteners are produced by reacting toluene with sulfur chloride or thionyl chloride in the presence of aluminum chloride and concentrated sulfuric acid. According to the inventor, "The chemical nature of the sulfurized and sulfonated brightening agents according to this invention is obscure . . .".

Beaver received a patent[3] for bright-copper plating from an acid sulfate bath containing sulfonation products of acetyl thiourea or of aryl- and alkyl-substitution products of thiourea, and Duponol 80.

To our knowledge, mirrorlike brightness is not obtained simultaneously with good ductility from any copper sulfate bath except those containing the Henricks-type brightener. This paper reports the experimental work which was done to define the specific compounds in this brightener and operating conditions for reproducing the Henricks-type bright-plating conditions.

Experimental Results

A study of the chemical reactions involved in the preparation of sulfonation products of sulfurized aromatic compounds resulted in the identification of definite organic compounds which were shown to be the effective brightening agents. These were entirely new in the field of organic brighteners for plating baths, and methods for producing them were developed. Brightening effects were obtained only when the new compounds were sulfonated under precise conditions. Three products produced the most effective results: sulfonated di-p-tolyl sulfide, sulfonated di-p-tolyl sulfoxide, and sulfonated di-p-tolyl disulfide. All three are necessary to produce copper deposits of mirror brightness. The sulfide- and sulfoxide-type compounds, when used individually, are effective for producing semibright to bright plates, but the operating ranges are somewhat narrow.

The outstanding characteristic of electroplate produced by the use of these addition agents, whether mat, semibright, or mirror bright, is the good ductility. The mat and semibright plates may be color buffed to a bright finish with extreme ease, requiring very much less wheel work than the ordinary molasses, acid copper plate. The bright and semibright plates are useful in protecting steel from surface oxidation when it is being heated. The copper deposited in the

*Battelle Memorial Institute, Columbus, Ohio.

presence of the three brighteners under discussion can be heated to 2000° F (about 1093° C), and when cooled, it still retains its easy-buffing qualities, which is in marked contrast to other copper plates.

Excellent results have been obtained by using the sodium salts of the sulfonated products, although the deposit was not quite so bright as when the acid products were used. When the sodium salt of the sulfonated "sulfide" was used with the regular sulfonated "sulfoxide" and sulfonated "disulfide", the plate was as bright as that obtained when all three acid products were employed.

Operation and Maintenance of the Bright-Plating Bath

These brightening agents can be used with the standard sulfuric acid-copper sulfate electroplating solution. While it is quite possible that the process will deposit bright plate beyond the boundaries given below, these were the investigated limits of successful operation:

$CuSO_4.5H_2O$	185–250 g/l (1.5–2.0 *N*)
H_2SO_4	50–100 g/l (1–2 *N*)
Sodium salt of sulfonated di-p-tolyl sulfide	0.1–2 g/l
Sulfonated di-p-tolyl sulfoxide	0.1–2 g/l*
Sulfonated di-p-tolyl disulfide	0.1–2 g/l*
Current density	5.4–11.3 amp/dm² (50–110 asf)
Temperature	27–43° C (80–110° F)

An example of a typical bright plating bath is as follows:

$CuSO_4.5H_2O$	210 g/l (1.7 *N*)
H_2SO_4	73.5 g/l (1.5 *N*)
Sulfonated di-p-tolyl sulfide	0.15 g/l
Sulfonated di-p-tolyl sulfoxide	0.5 g/l*
Sulfonated di-p-tolyl disulfide	0.3 g/l*
Current density	7.7 amp/dm² (72 asf)
Temperature	32–38° C (90–100° F)

The ratio of the quantities of the brighteners was an important factor in obtaining bright deposits. The ratio, "sulfide": "sulfoxide": "disulfide", should be approximately 1:3:2. If the quantities of the brighteners were doubled, but the ratio was maintained, bright plate could still be obtained provided the amounts did not exceed the operating limits. However, if brighteners were added in such a way that the ratio was appreciably disturbed, the change immediately became apparent in the appearance of the plate. If the "sulfide" component was in excess, rough nodular edges were produced. This effect could be counteracted by adding some of the "disulfide" component to restore the correct ratio. The amount of "sulfoxide" did not appear to be so critical. An excess of "disulfide" produced a milky plate or "orange peel" in low-current-density areas. In order to eliminate this effect, "sulfide" was added. This latter effect was also construed as a deficiency of the "sulfide", as well as an excess of the "disulfide". In general, then, an excess of "sulfide" (or too little "disulfide") caused poor deposits in high-current-density areas, and excess "disulfide", (or too little "sulfide") caused undesirable deposits in low-current-density areas. When the "sulfoxide" was present in too large a quantity, frosty plate or "zebra"-mottled dark-red plate resulted. If too little "sulfoxide" was present, striations and rough edges were produced.

The brighteners were consumed proportionally to the amount of current passed. Consequently, it was necessary to replenish the brighteners from time to time in order to continue the production of bright plate.

No methods of direct analysis for these three products were devised. The amount of a particular brightener component necessary was judged from the appearance of the plate in bent cathode tests.

A tendency was found for anode polarization, unless an anode-to-cathode ratio of 2:1 was used in the more concentrated bath containing 88 g/l H_2SO_4 and 225 g/l $CuSO_4.5H_2O$.

Work-rod agitation was preferred because of the excessive consumption of brighteners when air agitation was used. However, air agitation, if properly used, resulted in excellent plate. Improper air agitation produced striation on the deposit. Lack of agitation limited the current-density range.

Operation and Maintenance of the Semibright-Plating Bath

The sulfonated di-p-tolyl sulfoxide, when used as a single addition agent in the acid copper sulfate electroplating bath, caused the deposition of a very fine-grained mat plate with smooth edges and a glassy appearance. There are practical advantages to this type of semibright plate. The single addition agent afforded easier control, and cost of operation was appreciably reduced. Furthermore, this semibright plate was much more easily color buffed than a molasses copper plate. When a Watts-type nickel plate was deposited over the as-plated semibright copper plate, it too could be more easily buffed than a Watts-type nickel over as-plated molasses copper. Bumper guards plated with approximately 0.001 inch of the semibright copper showed a lustrous, smooth plate having a good hiding power. This deposit was easily buffed on an 11½-inch sewed wheel at 5300 rpm using tripoli for coloring. Magne-Gage tests showed less than 0.0001 inch removed in buffing.

Operating ranges for the semibright bath were as follows:

$CuSO_4.5H_2O$	185–250 g/l (1.5–2.0 *N*)
H_2SO_4	60–110 g/l (1.2–2.2 *N*)
Sulfonated di-p-tolyl sulfoxide	0.5–1.5 g/l*
Current density	4.3–10.8 amp/dm² (40–100 asf)
Temperature	27–38° C (80–100° F)

*Brightener actually weighed out for use consisted of the sulfonation product (about 10 per cent) and free sulfuric acid (about 90 per cent).

The following is an example of typical addition-agent concentration and operating conditions:

Sulfonated di-p-tolyl sulfoxide	1.0 g/l
Current density	8.0 amp/dm² (75 asf)
Temperature	38° C (100° F)

Several bright deposits with reflectivities approaching a mirror finish were produced with sulfonated di-p-tolyl sulfoxide alone. The brightener concentration was 1.25–1.5 g/l with the temperature at 29° C (85° F) and the sulfuric acid at 110 g/l. However, the current-density range was limited to 4.3–6.5 amp/dm² (40–60 asf).

Related Compounds as Substitutes

Many compounds related to the three agents possess brightening action to a lesser degree but are nevertheless useful in producing bright or semibright plate. Certain proprietary surface active agents were found beneficial when used in various combinations with the three products or, in one case, with only one of the products. Triton NE and Triton 720 have the effect of increasing the smoothness of the plate and of widening the current-density range when used with all three components. Triton NE, when used with the "disulfide" alone, produced bright plate. When du Pont MP-189 was added to a bath containing the three components, it also improved the smoothness of the plate.

The following paragraphs describe the results when various compounds related to the three brighteners were used as substitutes.

Sulfonated 2, 6-Dimethyl Thianthrene.—This compound was substituted for the sulfonated di-p-tolyl disulfide. It produced a smooth, uniform deposit over a wide current-density range. However, the edges were rough, and the plate was not so bright as when the sulfonated di-p-tolyl disulfide was used.

Sulfonated 2, 6-Dimethyl Thianthrene Monosulfoxide.—As a substitute for both the sulfonated di-p-tolyl sulfoxide and the sulfonated di-p-tolyl disulfide, this compound produced a semibright plate with rough edges and, in general, caused the deposition of a plate less bright than that obtained by the use of sulfonated 2, 6-dimethyl thianthrene.

Sulfonated Di-p-tolyl Disulfoxide.—Alone, and in combination with either the di-p-tolyl sulfide or di-p-tolyl sulfoxide or both, this compound had approximately the same brightening effect as the di-p-tolyl disulfide.

A bright deposit was obtained by using only two components, the sulfonated di-p-tolyl sulfide and the sulfonated di-p-tolyl disulfoxide, but the edges and corners were rough. This type of bath had a short life.

Sulfonated Di-p-tolyl Disulfone.—This compound behaved somewhat the same as the sulfonated di-p-tolyl disulfide and the sulfonated di-p-tolyl disulfoxide. The plate was fairly bright, but it was grainy and did not have "hiding power". The edge roughness could be eliminated only at the expense of the brightness.

Sulfonated Di-p-tolyl Sulfone.—This compound had no brightening effect under conditions investigated.

Sulfonated o-thiocresol.—Used with sulfonated di-p-tolyl sulfide and sulfonated di-p-tolyl sulfoxide, this compound caused plate that was bright only at high-current-density edges and corners.

Sulfonated Di-o-tolyl Disulfide.—This compound showed some brightening action when used in combination with sulfonated di-p-tolyl sulfide and sulfonated di-p-tolyl sulfoxide, but the deposits were undesirably rough.

Sulfonated Di-o-tolyl Chlorophenyl Disulfide.—Used alone or with sulfonated di-p-tolyl sulfide, this compound showed no brightening action. With sulfonated di-p-tolyl sulfide and sulfonated di-p-tolyl sulfoxide a mat "zebra" deposit was produced.

Sulfonated Diphenyl Sulfide.—This compound was used in combination with sulfonated di-p-tolyl sulfoxide and sulfonated di-p-tolyl sulfide. Bright deposits were obtained over a fairly wide range. The plate showed an "orange-peel" effect, however. Slightly larger quantities of this compound were required than of the corresponding di-p-tolyl compound. The bath life was much shorter with the phenyl compounds in place of the tolyl compounds.

Sulfonated Diphenyl Disulfide.—This compound showed some brightening effect, but the plate was rough in appearance and excessively rough along the edges.

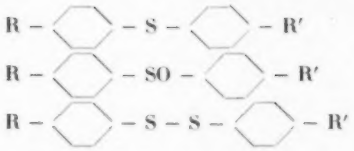
Sulfonated Diphenyl Disulfoxide.—Combined with the sulfonated di-p-tolyl sulfide and sulfoxide, this compound produced rough, bright deposits.

Other Sulfur-Containing Organic Compounds.—Since the sulfonated di-p-tolyl disulfide exhibited the least stability of the three compounds, attempts were made to improve it by oxidation or reduction. The resulting products were used with the standard sulfonated di-p-tolyl sulfide and sulfoxide. Oxidation of sulfonated di-p-tolyl disulfide had a deletrious effect, but the zinc-reduced product gave results as good or better than those usually obtained with the standard disulfide product.

Reduction products of the other two brighteners were prepared and tested. A slightly larger amount of the reduced sulfonated di-p-tolyl sulfide than of the standard product was required to produce a mirror finish of equal reflectivity. The effectiveness of the sulfonated di-p-tolyl sulfoxide was destroyed by reduction with zinc.

A synthetic sulfonic acid of di-p-tolyl disulfide, namely, 4, 4′-dimethyl diphenyl disulfide-3, 3′-disulfonic acid, was prepared by two methods and substituted for the standard product. The plate produced was rough, nodular, and semibright.

The foregoing discussion shows that phenyl, tolyl, and other aromatic sulfides, sulfoxides, and disulfides have brightener action when sulfonated and used in acid-copper plating baths. In general, it is considered that alkyl-aryl sulfur compounds represented by the following formulas are suitable:



where R and R′ represent hydrogen atoms or alkyl radicals.

Preparation of Brighteners

Most of the organic sulfur compounds used in this investigation were not available commercially. Di-p-tolyl disulfide was obtained from Eastman, but it was necessary to synthesize di-p-tolyl sulfide, di-p-tolyl sulfoxide, and many of the other compounds investigated. Improved procedures for synthesizing the sulfide, sulfoxide, disulfide, based on methods described in the literature, were developed.

The preparation of the brightening agents was a fairly critical process insofar as the sulfonation phase was concerned. The sulfonations of the sulfide and disulfide were carefully controlled, because oxidation by the sulfuric acid resulted in products which caused inferior copper plate or which had no brightening effect whatsoever. The sulfoxide is oxidized only by drastic treatment, so less care was necessary in sulfonating it.

The brighteners were made up into stock aqueous solutions by dissolving them in water and adjusting the volume so that ten milliliters were equivalent to one gram of the original product.

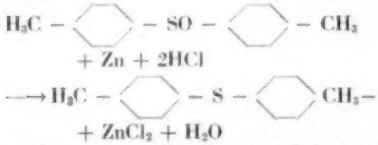
The following examples will serve to illustrate various methods of preparing the brighteners.

Preparation of Di-p-tolyl Sulfide

Materials:

Di-p-tolyl sulfoxide (crude)	1238 grams (5.38 mols)
Denatured alcohol	6250 grams (5 liters)
Zinc dust (commercial)	900 grams (13.8 mols)
Hydrochloric acid (concentrated, commercial)	2.5 kilograms (2.1 liters)

Reaction:



Procedure: In a 12-liter 3-necked flask fitted with a stirrer, a reflux condenser, and a thermometer, 1238 grams of crude di-p-tolyl sulfoxide were suspended in a mixture of 5 liters of denatured alcohol and 2.1 liters (2.5 kg) of concentrated hydrochloric acid. The mixture was heated to 80° C, and 900 grams of zinc dust were added in portions at a temperature of 80–85° C over a period of 2 hours. The mixture was refluxed for 6 hours and stirred overnight with no further heating. The mixture was decanted from excess zinc into 10 gallons of cold water in a 15-gallon crock. The remaining mixture was extracted from the zinc with 500 ml of ethanol, and the ethanol solution added to the aqueous suspension. The aqueous suspension was allowed to settle and was then filtered. The precipitate was crystallized from methanol. The combined yield of crystalline material (several crops) was 720–780 grams, or about 65 per cent of theoretical. The crystallized material melted at 54–56° C.

Preparation and Isolation of Sodium Salt of Sulfonated Di-p-tolyl Sulfide

Materials:

Di-p-tolyl sulfide	120 grams
Concentrated sulfuric acid	1440 grams
Calcium carbonate (cp, low alkali)	(approx.) 1800 grams
Sodium carbonate (anhydrous)	(approx.) 70 grams

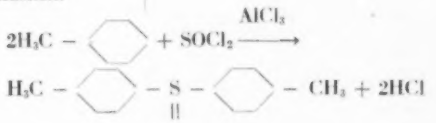
Procedure: The acid was placed in a 3-necked flask fitted with a stirrer and a thermometer. The sulfide was melted and added to the acid at a temperature of 45–50° C. The time required was about 20 minutes. The mixture was then maintained at a temperature of 45–50° C for four hours, with constant stirring; the resulting product was poured into ice water and neutralized by the addition of calcium carbonate. The calcium sulfate was filtered off and washed twice by resuspension in water. The combined filtrates were neutralized to a permanent *p*H of 9 with sodium carbonate, avoiding an excess of the latter. The calcium carbonate was filtered off, and the filtrate was evaporated to dryness on a steam bath. The yield was about 275 grams of the sodium salt, but this figure is subject to variation, depending on the completeness of washing of the calcium sulfate.

Preparation of Di-p-tolyl Sulfoxide

Materials:

Toluene (cp)	2180 grams (2500 ml; 23.7 mols)
Thionyl chloride (commercial)	1190 grams (708 ml; 10 mols)
Anhydrous aluminum chloride (commercial)	1300 grams (10 mols)
Denatured alcohol	(approx.) 3600 grams (4500 ml)
Ice	

Reaction:



Procedure: In a 5-liter 3-necked flask fitted with a mechanical stirrer and a thermometer and having the third neck arranged for addition of aluminum chloride, were placed 2180 grams (2.5 liters; 23.7 mols) of cp toluene and 1190 grams (708 ml; 10 mols) of thionyl chloride.

This mixture was cooled to 10° C in an ice-salt bath. Through the third neck of the flask, 1330 grams (10 mols) of anhydrous aluminum chloride were added, while the temperature of the mixture was maintained at 10° C. Addition of the aluminum chloride required 3 hours. The mixture was stirred for about ½ hour additional and was then poured onto 10 kg of chopped ice in a 5-gallon crock. The mixture was stirred to complete the hydrolysis of the aluminum chloride. The crude sulfoxide was filtered off and suspended in boiling water (about 3 liters of water for each kilogram of the crude wet material). The suspension was stirred vigorously to wash the material and to form smaller lumps upon cooling. The crude sulfoxide from the washing was filtered off and dried in the air overnight. The yield of crude product varied from 1785 to 2240 grams (78–98 per cent of the theoretical based on the thionyl chloride). The crude material melted over the range 80–90° C. It is suitable for reduction to di-p-tolyl sulfide, but the sulfoxide used for sulfonation is subjected to the purification described below.

Seven hundred and fifty grams of the crude dry sulfoxide were suspended in 1500 ml of denatured alcohol. This suspension was heated to boiling. Then 1500 ml of hot (80° C) water were added, and the mixture was placed in an ice bath and cooled with vigorous stirring. The purified material was creamy white and melted at 90–92° C. The yield of purified di-p-tolyl sulfoxide was 70–88 per cent based on the thionyl chloride.

Preparation of Sulfonated Di-p-tolyl Sulfoxide

Materials:

Di-p-tolyl sulfoxide (purified)	100 grams
Fuming sulfuric acid (20 per cent free SO_3 content)	900 grams

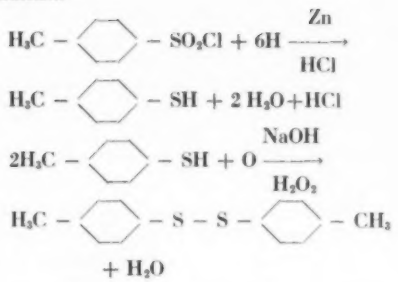
Procedure: The sulfoxide was added to the acid in a 3-necked flask fitted with a stirrer and a thermometer and having the third neck open for the addition of the sulfoxide. The mixture was maintained at a temperature below 50° C by external cooling. After all of the sulfoxide had been added (about 20 minutes), the mixture was heated with stirring to 100° ± 2° C and maintained at this temperature for 1 hour. The sulfonation mixture was cooled and was then ready for use.

Preparation of Di-p-tolyl Disulfide

Materials:

p-toluenesulfonyl chloride (commercial)	1000 grams (5.25 mols)
Zinc dust (commercial)	2000 grams (30.6 mols)
Hydrochloric acid (concentrated, commercial)	8.2 kg (7 liters)
Sodium hydroxide	(approx.) 250 grams
Hydrogen peroxide (15 per cent)	(approx.) 850 grams
Methanol	12 liters

Reaction:



$$H_3C - C_6H_4 - SO_2Cl + 6H \xrightarrow[HCl]{Zn} H_3C - C_6H_4 - SH + 2H_2O + HCl$$

$$2H_3C - C_6H_4 - SH + O \xrightarrow[H_2O_2]{NaOH} H_3C - C_6H_4 - S - S - C_6H_4 - CH_3 + H_2O$$

Procedure: Five liters of concentrated hydrochloric acid were placed in a 22-liter flask fitted with a large mechanical stirrer and a thermometer and cooled in an ice bath. The acid was cooled to 10–15° C, and while this temperature was maintained, 100 grams of p-toluenesulfonyl chloride were added. Then, at the same temperature, a 100-gram portion of zinc dust was added over a period of about 15 minutes. After 5 such 100-gram portions of zinc and sulfonyl chloride had been added alternately, an additional 1-liter portion of acid was added. Five more additions of sulfonyl chloride and zinc were made, followed by another 1-liter portion of acid. The mixture was then stirred for one hour at 10–15° C in the ice bath. At the end of this time, the mixture was heated to 40° C during a period of about 30 minutes. One kilogram of zinc dust was added next in small portions over a period of one hour, during which time the temperature was allowed to rise to 60–65° C. The mixture was subsequently boiled vigorously to steam-distill the thio-p-cresol formed. The latter was allowed to solidify in the receiver and was separated from the water by filtration. The crude thiocresol was dissolved in 2500 ml of 10 per cent sodium hydroxide solution and oxidized at 15–20° C by the portionwise addition of 15 per cent hydrogen peroxide until no further precipitation of di-p-tolyl disulfide occurred (about 850 grams of 15 per cent peroxide were required).

The di-p-tolyl disulfide was filtered off and crystallized from about 12 liters of methanol. The yield of disulfide (mp 45–47° C) was 500–550 grams (78–86 per cent of the theoretical).

Sulfonation of Di-p-tolyl Disulfide

Materials:

Di-p-tolyl disulfide	10 grams
Fuming sulfuric acid (15 per cent free SO_3 content)	360 grams

Procedure: The acid was placed in a 3-necked flask fitted with a stirrer and a thermometer and cooled to 10° C in an ice bath. The disulfide was added over a period of 15–25 minutes, the temperature being kept at 10–15° C. After the addition, the ice bath was removed, and the mixture was allowed to come to

(*Continued on page 1060*)

PRODUCTION BARREL PLATING

with nickel fluoborate solution

R. J. O'CONNOR

President, Contract Plating Company, Stratford, Conn.

NICKEL FLUOBORATE suitable for use in plating solutions is now available to industry. The high conductivity of these solutions would seem to make them especially meritorious for nickel barrel plating. Other advantages of this system over the conventional sulfate-chloride baths include relative insensitiveness to metallic impurities, ease of control and maintenance, stability to *p*H changes with a minimum of sludging, and high solubility of the nickel salts.

Because of our constant interest in improving processes, a production barrel unit was set up in our plant to determine whether the merits of this system, as indicated by laboratory tests, could be realized in production.

Procedure

A nickel fluoborate solution was placed in a Lasalco Richards-type barrel. The solution was made up by diluting 75 gallons of nickel fluoborate concentrate furnished by General Chemical Division, Allied Chemical & Dye Corporation, with water to make 250 gallons of plating solution containing 55 g/l (7.3 oz/gal) of nickel. The *p*H of the solution was checked colorimetrically and found to be 3.0. Steel stampings of identical bulk were plated in this bath and in our regular production tanks, which hold 135 gallons of solution. The parts were selected because their shape would give a good indication of the throwing power of the solutions being compared. It was found that the throwing power of the original fluoborate bath was not equal to that of the ammonium ion-containing nickel bath used in the production barrels. In order to improve the throwing power of the fluoborate bath, 104 lb of ammonium fluoborate was added, after which the bath had the following composition:

Nickel fluoborate, $Ni(BF_4)_2$	220 g/l (29.3 oz/gal)
Nickel, Ni	55 g/l (7.3 oz/gal)
Ammonium fluoborate, NH_4BF_4	50 g/l (6.7 oz/gal)

The solutions used in our production barrels had the following nominal composition:

Nickel, Ni, as sulfate	30 g/l (4 oz/gal)
Ammonium chloride, NH_4Cl	30 g/l (4 oz/gal)

At times this bath was operated close to the saturation point of nickel ammonium sulfate. A typical analysis when this condition prevailed was as follows:

Nickel, Ni	40 g/l (5.4 oz/gal)
Chloride expressed as NH_4Cl	51 g/l (6.8 oz/gal)

The amperage drawn by the fluoborate barrel at 6 volts was 115 amperes; the production barrel drew 90 amperes at the higher chloride content and 60 amperes at the lower chloride content*.

Throwing Power

Representative production parts plated in the baths were sectioned, and the thickness of the nickel was measured on the outer and in the recessed areas. The results, which were checked a number of times on different barrel loads, are shown in Table I. It is

*The difference in current drawn is the same as found in other plants using the same equipment for both types of solution. Mechanical differences—tank volume, anode-to-cylinder distance, etc.—offset each other in the equipment used here.

TABLE I. DISTRIBUTION OF NICKEL PLATE

Load No.	Thickness of Nickel Plate, inch					
	Fluoborate Solution			Sulfate-chloride Solution		
	Surface		Ratio O/I	Surface		Ratio O/I
	Outer	Inner		Outer	Inner	
1	0.0005	0.00018	2.7	0.00032	0.00013	2.5
2	0.0007	0.0002	3.5	0.00036	0.0001	3.6

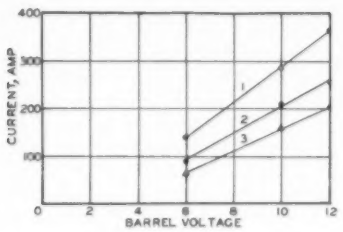


Fig. 1. Voltage across barrel vs. plating current with (1) nickel fluoborate, (2) nickel sulfate-high ammonium chloride, (3) nickel sulfate-normal ammonium chloride solutions

seen that while the deposits from the fluoborate bath were about twice as thick as the deposits from the production bath at the same voltage, the ratio of the deposit thickness on the outer and in the recessed areas was about the same for the two baths.

Color of Deposits

In day by day production, the color of the nickel deposited from the fluoborate bath was uniformly better than that from the production baths and uniform over high and low current density areas. The operators often remarked that the deposits from the fluoborate bath had a more bluish white color.

Fig. 2. Parts barrel plated in fluoborate nickel solutions. The broomhandle caps in upper left and lower right corners and the two sets of buckles adjacent the former were plated in a solution containing brighteners, the remaining parts in a brightener-free solution

Tests at Higher Voltage

A number of barrel loads were plated with 12 volts impressed across the tank. The deposits produced at this voltage were excellent both in appearance and adhesion. The plating rate was again about double that of the production solutions operated at 12 volts, as illustrated by the plot of tank voltage versus plating current in Fig. 1. The fluoborate solution did not heat excessively even at this high voltage, and the temperature was readily controlled by running cooling water through coils provided for the purpose.

Covering Ability

It was noted in these tests that the nickel from the fluoborate bath appeared to cover the work being plated very rapidly. Coupled with the reported high tolerance of the bath for metallic contamination, the high covering ability should reduce the necessary frequency of purification of the bath, which would be of extreme interest when plating brass articles that normally cause rapid solution contamination. A study was made, and it was found that purification treatment need not be as frequent as usual.

Bath Maintenance

At this writing, the fluoborate nickel bath has been in continuous production operation for about 15 months.

The solution *p*H increased gradually from 3.0 to 4.3 in about five months, and 2 gal of 42 per cent plating-grade fluoboric acid was added to reduce the *p*H to 4.0. Since that time it has increased to 4.5. The bath was originally operated at a Baumé of 28.3° (70° F). After about six months the Baumé reading was 23.7°. Draining of the work and unloading the barrel into baskets above the tank contributed to the remarkably low dragout loss.

The bath has shown excellent stability in use, as evidenced by an exceptional freedom of sludge. In addition, both the barrel and the tank are entirely free of nickel salt accumulation, so common to other nickel plating baths. (*Continued on page 1056*)

leaders

in the

industry xxviii

Clarence h. Sample

CLARENCE H. SAMPLE was born on September 21, 1906 in Spencer, Idaho, a village consisting of a "headquarters" building of a livestock company and a few frame houses. Among the first pleasant things he remembers are catching trout from the little creek alongside the village and riding buckboard (a light, four-wheeled wagon without body or springs but with long elastic boards supported at the ends directly by the axles) through the roadless and wild sheep country.

While still a youngster, Sample moved with his parents to a farm in the Boise Valley. There he attended a typical two-room country school until he went to Meridian High School. After graduation, in 1925, he worked his way through the University of Idaho in Moscow. During this period he spent two strenuous but enjoyable summers as a "smoke chaser" with the U. S. Forest Service in a remote section of the Clearwater National Forest on the Idaho-Montana border.

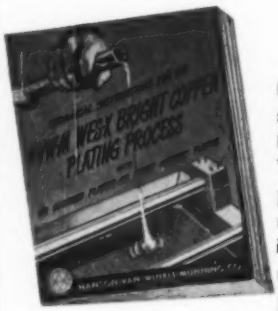
After he had received his degree of B.S.Ch.E. in 1930, Mr. Sample joined the Technical Staff of Bell Telephone Laboratories, Inc., in New York City, where he was engaged in research and development work on corrosion and metallic finishes until 1945. While at Bell Laboratories, he earned an M.A. degree in Physical Chemistry, in 1938, through part-time and evening work at Columbia University. In 1946 he joined the Electroplating Section of The International Nickel Company, in New York City.

Mr. Sample has been particularly concerned with the development of reliable test methods, and he has therefore been active in the work of the American Society for Testing Materials, especially in its Committes A-5 and B-3 on corrosion of iron and steel and of nonferrous metals, respectively, and B-8 on Electrodeposited Metallic Coatings. Its secretary 1943–1947 and since then its chairman, Mr. Sample has earned much of the credit for the growth of the latter committee's activities and influence. He is also a member of the Advisory Committee on Corrosion and the Administrative Committee on Papers and Publication of the A. S. T. M.

In the American Electroplaters' Society, Mr. Sample has been active as A. S. T. M. Liaison to the Research Committee. He served as a member of its Project Committee No. 9 on "Physical Properties of Electrodeposited Metals", until he recently became chairman of its new Project Committee No. 13 on "Correlation of the Weathering Behavior of Electrodeposited Coatings with Their Permeability to Gases". In 1949 he was the chairman of the Paper Awards Committee. In the same year he received the Society's Award of Merit in recognition of his services.

Mr. Sample holds membership in a number of other societies, among them National Association of Corrosion Engineers, American Society for Metals, The Electrochemical Society, and American Chemical Society. He is a popular lecturer and writer on corrosion and specification subjects.

Mr. Sample's boyhood experiences probably account for his continued interest in the wide open spaces, for which he has found an acceptable substitute in a sparsely populated area on the North Shore of Long Island, about 50 miles from New York. Here he has ample opportunity to pursue his hobbies—boating, swimming, studying the varied bird and marine life, fishing and shooting—and incidentally to supplement the Sample bill of fare with a variety of fresh sea food.



If you are interested in smoother copper plating, investigate this process. Wes-X Copper used with PR plating is your passport to maximum leveling, buffability, speed, ductility, throwing and covering power — completely eliminates all organic additions to the bath. The Wes-X addition agent is a mixture of inorganic, metallic compounds. Deposits are considerably softer, brighter, smoother and easier to buff. When Wes-X is used with the Period Reverse Plating Process, even better operating and deposit advantages are obtained. Very often, there's no need for buffing after plating. Write for technical instructions bulletin.

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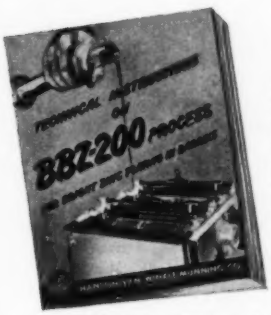

Look here for real economy in zinc barrel plating. This is undoubtedly the simplest and most economical process for securing bright to brilliant deposits directly from the barrel. H-VW-M developed the BBZ-200 Bright Barrel Zinc Process exclusively for barrel plating. It produces its characteristic brilliant deposits over a wide range of current densities and eliminates the necessity for subsequent bright dipping. Low concentration of BBZ-200 Brightener in the bath and low consumption combine to provide maximum economy. For details on the use of the BBZ-200 Process, write for the technical bulletin.

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CHOICE OF GLOVES IN THE PLATING ROOM

MAX A. WILLIAMS

Edmont Manufacturing Company, Coshocton, Ohio

THAT PLATERS and platers' helpers need gloves in their work is well recognized because of the many hazards to the hands encountered in plating rooms. For that reason, gloves are used in every plating room, independent of its size and whether it has the smallest manually operated equipment or large fullautomatics.

That there are important differences between gloves is, however, not always understood. Some light is shed on this problem by an investigation made by E. H. Krall of Krall Plating Company, Cleveland, Ohio, as a part of a general safety study in his plant.

Mr. Krall, who operates one of the largest zinc plating job shops in the United States, began his initial survey early in 1949. First, his employees were supplied with heavy-gauge unlined rubber gloves, and complete wear records were kept. Periodic check of these records revealed that almost without exception failure was the result of snagging or tearing rather than wear. Since such failure would occur at any time, from a few minutes to several days after the gloves had been placed in service, it was extremely difficult to predetermine the number of gloves necessary to fill the plant requirements over a definite period of time, i. e., to establish a reasonably accurate glove "life expectancy". It was found, however, that glove cost per ton of finished product was considerably higher than originally had been anticipated.

A second series of tests were arranged in which fabric gloves coated with acid-proof synthetic or natural rubber were used, and again accurate wear records were kept. A comparison of the records made it possible to establish the most efficient style and type of hand protection from the standpoints of safety, economy, wearing quality, and hand comfort. It was found that a 14-inch gauntlet-style glove coated with Neox, a neoprene compound, provided the greatest degree of protection both from abrasion and from the deteriorating effects of corrosive chemicals. Operators of the conveyor-type dryer, who continuously handle product heated to approximately 200° F, voiced a preference for a short "Safety Cuff" type of gauntlet coated on the palm surface only with roughly finished natural rubber. These workers found that the combination of cotton fabric and rubber provided excellent protection against the heat and that the surface of the glove coating afforded a non-slip grip.

The final analysis of the records showed that, while costing approximately 50 per cent less than the ordinary unlined types tested, the coated-fabric gloves were considerably longer wearing and provided a greater degree of hand protection.

While programs of this type require close supervision and the full cooperation of all personnel involved, they produce worthwhile results. Of primary importance is, of course, the reduction in accidents made possible by the use of the proper glove. Secondarily, and this is a point often overlooked by employers, much good will is created by permitting the employee to have an important part in the choice of his gloves.

PLATING WITH RHODIUM AND PALLADIUM

KARL SCHUMPELT

Chief Electrochemist, Baker & Company, Inc., Newark, N. J.

OF THE SIX METALS of the platinum group, only three have found practical applications in the electroplating industry: platinum, palladium and rhodium.

Some figures showing the relation between thickness, weight, and cost of the several metal deposits should be of interest and are given in Table I.

Platinum Plating

Since little platinum plating is done at present, a short review of the developments may suffice.

As far back as 1885, Roseleur had published a formula for a platinum plating bath which formed the basis for a number of modifications and improvements. In spite of their shortcomings, these solutions were adequate for the very limited needs of that time.

With increasing demand for heavier platinum deposits during the first quarter of this century, the definite need for a better plating solution stimulated renewed research, which resulted in a number of patents[1–6]. All these solutions, for maintenance of the metal content, had to be replenished by salt additions which, in comparatively short time, adversely affected the operation of most of the baths.

The introduction of the ammino nitrites of platinum[1,2] therefore was an important step forward in the art of platinum plating because it made possible the continuous replenishing of the bath without the accumulation of undesirable salt residues. The NH_3 and the NO_2 radicals react with other constituents of the bath to form nitrogen gas and water.

Rhodium Plating

At about the same time, a large number of patents[7–14] for rhodium plating solutions were granted,

TABLE I. DATA ON PLATINUM METALS

	Platinum	Palladium	Rhodium
Deposit thickness, inch	0.00001	0.00001	0.00001
Deposit weight, mg/in^2	4	2	2
Cost per in^2, cent	0.278*	0.116†	0.62
Thickness of 1 mg/in^2 deposit, inch	0.0000025	0.000005	0.000005

*Based on a market price of $69.00 per ounce troy
†Based on a market price of $24.00 per ounce troy

opening a new era in the field of precious-metal plating. Although it had been comparatively unknown to the plater up to that time, rhodium soon was accepted as the standard precious-metal finish for all white jewelry, novelties, and related articles.

Silver and silver plated articles are plated with rhodium to prevent or retard tarnishing without the necessity of lacquering. White-gold jewelry is rhodium plated to prevent discoloration, and even jewelry made of solid platinum receives a rhodium finish to enhance its appearance and increase the reflections and briliance of diamonds.

Besides of the numerous applications of purely ornamental character, where rhodium is applied as a flash plate rarely exceeding a thickness of 0.000005 inch (0.125 μ), there are many industrial uses where its chemical and physical properties have proved of great value. Typical examples are: watch movements, where rhodium plate eliminates the danger of finger stains, and all-metal surface reflectors, where hardness and permanent reflectivity are required. During and since the war an ever-increasing use is made of rhodium plating in the field of communications, electronics, and radar.

Preparation of Rhodium Solutions

Unlike platinum and palladium, rhodium is not attacked by aqua regia; in order to convert it into water-soluble salts, the following methods are commonly used:

1. Mixing with sodium chloride and heating in chlorine gas
2. Fusing with bisulfates
3. Prolonged heating with sulfuric acid

The process of dissolving rhodium is slow, and the rate depends greatly on the pretreatment and the origin of the metal sponge.

Rhodium, like the other metals of the platinum group, shows a pronounced tendency for formation of complex salts, and for that reason its chemistry is highly specialized. The compounds with inorganic acid radicals such as Cl^-, NO_2^-, SO_4^{-2} and PO_4^{-3} usually contain the rhodium in form of a more or less stable complex anion. When dissolved in water, these complexes dissociate only to a very slight degree and do not show immediately the typical reactions of the respective acid radicals.

The rhodium solutions prepared by the methods mentioned above are not directly suitable for plating purposes. From them the metal is usually precipitated as the hydroxide, which is redissolved in either sulfuric or orthophosphoric acid. Rhodium sulfate and phosphate complexes in concentrated solution of guaranteed metal content are today the accepted trade products for the preparation of rhodium plating solutions.

Depending on the manufacturer's instructions, as well as on special requirements and preferences of the plater, two types of plating solutions are widely used: the sulfuric and the phosphoric acid baths.

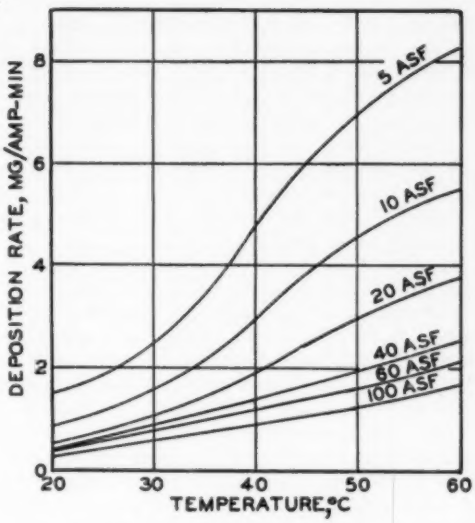

Fig. 1. Effect of temperature and current density on rate of rhodium deposition

Typical formulas are the following:

1. Water ..... 1 liter
   Sulfuric acid ..... 20 milliliters
   Rhodium, in prepared solution 2 grams
2. Water ..... 1 liter
   Orthophosphoric acid, 85% ..... 10–40 milliliters
   Rhodium, in prepared solution 2 grams

In making these plating solutions, it is important to mix the acid with the water before the rhodium is added, otherwise a precipitate of rhodium hydroxide is formed by hydrolysis. While this precipitate may dissolve again after subsequent addition of acid, the plate from the solution will be very poor.

Rhodium Plating

Plating can be done at room temperature, but the most favorable range is between approx. 110° and 120° F (approx. 40° and 50° C). Current densities of from 10 to 80 asf (1.1 to 8.6 amp/dm²) may be applied at from 2½ to 5 volts.

The diagram in Fig. 1, computed from data on one commercial solution, shows the relation between temperature and current density against the rate of deposition in milligrams per ampere-minute.

The cathode efficiency of a rhodium plating bath as described above is low and may vary between 10 and 20 per cent (based on trivalent rhodium) at about 20 asf (2.1 amp/dm²) and 109° F (43° C) depending on the manufacturer's specifications.

Solutions with the higher efficiency (20 per cent) are, as a rule, not quite as tolerant to changes in current densities and may produce a slightly milky de-

posit after more than two minutes' plating time. Under otherwise equal conditions, the rhodium bath of the lower cathode efficiency (10 per cent) should yield perfectly bright and clear deposits for at least 30 minutes, when they reach a thickness of 0.000045 inch (8.6 mg/in²; 2.6 μ).

A few observations made during twenty years of servicing rhodium installations, large and small, are given here in the hope that they will help the plater to turn out satisfactory work.

Insufficient or improper cleaning is the most frequent cause of trouble. All work coming from the polishing room should be carefully freed from adherent or imbedded grit and rouge. Besides vapor degreasing, brushing with soap and ammonia is most effective. The work is then placed on wires or racks and goes into the electrocleaner, which may be made from any of the products offered by the trade. Direct-current cleaning in a free rinsing cleaner is preferred and safer than combination direct-and-reverse cleaning in some of the new cleaning compounds containing emulsified solvents which are now on the market.

Very thorough rinsing in running water and, if possible, spray rinsing should follow in order that all traces of alkali film be removed. A dip in 10 per cent by volume sulfuric or hydrochloric acid and a water rinse conclude the preparatory cycle.

All articles made of base metals, including silver, should receive a nickel underplate before rhodium is applied. This is necessary for two reasons:

1. The rhodium deposit is porous
2. It is usually very thin, seldom more than 0.00001 inch (0.25 μ) thick.

Most standard nickel solutions are suitable as long as they give a bright deposit during the comparatively short plating time of about three minutes which is sufficient for most small jewelry not subjected to hard wear. Articles designed for better wear receive, as a rule, a heavier nickel plate and are usually plated in one of the bright-nickel solutions which are now widely used. While all of them give excellent results so far as the nickel alone is concerned, we prefer the nickel-cobalt-formate type over those with sulfur-containing brighteners.

If during the rhodium plating the hydrogen bubbles evolved on the cathode show a tendency to grow and cling to the work, it is a sure sign that the cleaning was insufficient; dark spots on the surface will be the result. However, similar brownish stains or very fine pimples may also form on bright-nickel deposits from solutions with sulfur-containing brighteners. These stains, under close examination, look almost nonmetallic and seem to have no rhodium deposits.

It is unavoidable that in the course of time impurities will accumulate in the bath, notably nickel and iron. Fortunately, the tolerance of the rhodium bath for these metals is fairly large, the only effect being a gradual degradation of the brilliant bluish-white color. Additions of sulfuric acid above the normal amount will partially restore the original color. Contamination with copper, tin, or zinc are definitely harmful.

A. Brenner[15] of the National Bureau of Standards has published and patented a method for removing metallic impurities from a rhodium bath by additions of a carefully measured quantity of potassium ferrocyanide. However, the filtration of the whole bath through activated carbon which must follow causes a substantial loss of rhodium.

Heavy rhodium deposits, up to 0.001 inch (25 μ) have occasionally been required and obtained from the following bath:

Water	1 liter
Sulfuric acid	100 milliliters
Rhodium metal, as rhodium sulfate	10 grams

This bath, operated at 122° F (50° C) and 5 asf (5.4 amp/dm²) gives a deposit weighing 17 to 19 mg/amp-min at approximately 90 per cent cathode efficiency, bit it is dull and, although smooth, rather difficult to polish.

Platinum anodes are used for rhodium plating; they are insoluble, and the rhodium in the bath must therefore be replenished with concentrate supplied by the manufacturer and used to prepare the original bath. As a consequence, the acid radical—sulfuric or phosphoric—accumulates in the bath, but it has no adverse effect except perhaps a slight decrease in the cathode efficiency.

The relation of anode and cathode area is not critical unless the current densities are very high and the distance between anode and work rather small; then protruding work areas are apt to be burned.

In very large sulfate-bath installations, pure lead anodes coated electrolytically with a film of lead superoxide have sometimes taken the place of platinum, but not without slight risks. Suspended particles of lead sulfate settling on the work cause so-called "birdseye" spots and make frequent filtration necessary. Also, after each interruption of plating, the anodes show a high resistance against the passage of current, that requires time to break down. Lead anodes cannot be used in the phosphoric acid bath.

Suitable containers for rhodium solution are pyrex glass, high-grade glazed stoneware, Lucite, and Tygon-lined steel tanks. They are usually placed in water jackets for heating. Electric immersion heaters, if mounted in quartz sheaths, can be used for smaller units with some precaution. Rhodium solutions deteriorate if heated above 60° C (140° F) for any length of time. To prevent local overheating the temperature gradient between heater and solution should be kept as low as possible; constant agitation of the solution will help.

Due to its insolubility in acids and aqua regia, rhodium cannot be stripped directly. Since almost all rhodium plated articles have a nickel underplate, rhodium can be removed in a regular nickel strip with reversed current, which will act through the pores in

the rhodium deposit. A thorough study of this action has been made by M. Shapiro[16].

Palladium Plating

While palladium or some of its alloys are eminently suited for certain lines of jewelry, palladium electroplate has never gained great popularity as an ornamental finish. Only during the last war, when platinum and rhodium were not available for nonessential applications, was palladium plating used to some extent in the jewelry and related industries.

It is in the field of electronics, radar, and communication devices that palladium electroplate has found its widest and most important use. Beginning during the last world war, the demand for palladium plating has been steadily increasing, and in the recent past it has assumed notable proportions.

A summary review of the history of palladium plating shows that it was first mentioned by Smee[17] in 1841. Franz[18] used an alkaline solution of palladium cyanide in potassium ferrocyanide, for which he obtained a patent. Pilet and Carry [19] plated palladium from a solution containing palladium chloride and dibasic ammonium and sodium phosphates. Beginning around the year 1930, a number of patents were granted covering the plating of palladium alone or as one of the metals of the platinum group[20–37]. Most plating solutions proposed in these patents use as the principal constituent a palladium diammino complex salt of the type $[Pd(NH_3)_4R_2]$ where R represents chloride, nitrite, or cyanide. As a rule, these compounds are very slightly or not at all soluble in water and, being nonpolar, are nonconductors. By addition of ammonia the complex changes from diammino into tetrammino form and becomes soluble and ionized. For better conductivity of the electrolyte and for improved throwing power, suitable salts such as alkali or ammonium chlorides, sulfates, or phosphates may be added.

Platinum or palladium anodes are used, but both are insoluble. The metal content of the bath must therefore be replenished by the addition of the metal salt, and this raises the problem of salt accumulation in the electrolyte and the adverse effect on its operation. Like in platinum plating, the introduction of palladium ammino nitrite solved the replenishment problem and eliminated the formation of undesirable inert matter.

A typical formula for a palladium bath of the ammino nitrite type is as follows:

Water	1 liter
Palladium, as diammino nitrite	4 grams
Sodium chloride	25 grams
Sodium nitrite	8 grams
Ammonia	50 milliliters

This bath is operated between 100 and 120° F (approx. 40 and 50° C) at 4–6 asf (4.3–6.5 amp/dm²). The metal-ion concentration is low, and unless agitation is provided the polarization rises rapidly to the point of hydrogen evolution, resulting in black and burned deposits. A current density of 6 asf (6.5 amp/dm²) makes effective agitation necessary.

The cathode efficiency at low current densities (4 asf; 4.3 amp/dm²) is 94 per cent, or 31 mg/amp-min; it drops with increasing current density.

In the electronic industry, which uses large amounts of palladium, a self-sustaining bath replenishing its metal from soluble palladium anodes has found great favor, because in large installation with a substantial turnover of metal, operation of a bath requiring constant analysis and replenishing would be quite cumbersome. The following formula is recommended:

Water	1 liter
Palladium as sodium palladium chloride	5 grams
Sodium nitrite	14 grams
Sodium chloride	40 grams
Boric acid	10–30 grams

The bath is operated at about 120° F (50° C) and current densities of from 4 to 10 asf (4.3 to 10.8 amp/dm²), with mild agitation.

At *p*H 4.5–6.0, the palladium anodes dissolve with 100 per cent efficiency or higher, but as the *p*H is made higher, the solubility drops, until at *p*H 7 and above the anodes become insoluble.

The cathode efficiency ranges from 95 to 75 per cent (31 to 25 mg/amp-min) depending on current density and agitation.

With an anode efficiency of 100 per cent or higher and a cathode efficiency of less than 95 per cent, the *p*H of the bath is bound to increase and should be restored by occasional additions of hydrochloric acid. This is about the only regularly required control. An occasional analysis for metal content will indicate whether additions of sodium palladium chloride are necessary.

Palladium deposits of 0.0001-inch (2.5-μ) thickness which did not require polishing have been produced from this bath.

There are several proprietary palladium solutions on the market on which we cannot report in this article due to lack of sufficient data.

The industrial applications of palladium in the electronic field usually call for a thickness of 0.00004 inch (1 μ) equivalent to 8 mg/in².

The most suitable underplate for palladium is a silver strike or light silver plate. A nickel underplate has a tendency to cause peeling of the palladium deposit.

Palladium deposits can be stripped with reversed current in an electrolyte consisting of 50 g/l sodium chloride, 20 g/l sodium nitrite and slightly acidified (*p*H 4–5) with hydrochloric acid, using current densities of 4–6 asf (4.3–6.5 amp/dm²) at 122° F (50° C).

Bath Analyses

For the determination of *rhodium* in plating solution colorimetric sets are available; however, the error

(*Continued on page 1056*)

Barrel Plating

(*Continued from page 1046*)

Bright Plating

A series of tests were run to investigate the use of the fluoborate nickel bath for bright plating in barrels. An addition of a common organic brightener, p-toluene sulfonamide, which is readily available, was made in the amount of 0.2 g/l (0.027 oz/gal). Steel stampings plated in this bath were brighter but did not exhibit the full luster required. The concentration of the organic addition agent was raised to 0.5 g/l (0.067 oz/gal) with no further brightening. Cadmium sulfate was then added so that the cadmium content was 0.1 g/l (0.0134 oz/gal). The deposits were of a brightness that compared favorably with those from the production bright-nickel barrel solutions in the plant. The brightness was uniform over a wide range of current densities on the parts plated. Actually the parts used in the test were those which presented the biggest problem in the shop.

Conclusions

The following advantages were confirmed in the production tests described:

1. At the same voltage, the plating rate in the nickel fluoborate bath is about twice that in ammonium-containing sulfate-chloride baths. This represents a saving in time and electrical power.

2. The throwing power of the fluoborate bath at the higher plating rates is equal to that of ammonium-containing sulfate-chloride baths at their usual plating rates.

3. The color of the deposit is better than that of deposits from ammonium-containing sulfate-chloride baths.

4. The cost of maintenance of the bath is very low; actually it was found to be 2 gal fluoboric acid ($2.80) per 250 gal of solution in 4½ months.

5. The bath responds to standard brighteners, giving better-than-usual color in recesses, and can be used at higher current densites than ammonium-containing sulfate-chloride baths.

6. Control of the bath is simple, involving only colorimetric *p*H and hydrometer readings.

7. There is no salting out on tanks and equipment.

8. The bath is stable with respect to *p*H, little sludging being noted.

The initial chemical cost of the bath, which is higher than that of the conventional sulfate-chloride solutions, and the necessity of using rubber-lined tanks can both be offset by the cited advantages.

Acknowledgment

The writer wishes to express his appreciation for the cooperation of the General Chemical Division, Allied Chemical & Dye Corporation, and to Mr. Clifford Struyk of that company for technical assistance in this work.

Rhodium and Palladium

(*Continued from page 1055*)

is fairly large and may run to ±10 per cent. The presence of base metals in the bath may make a color comparison impossible.

If no base metals are present, rhodium can be removed from a sample almost quantitatively by electrolysis with a rotating platinum-gauze cathode.

The standard analytical method for the separation of rhodium from base metals calls for digestion of a 10-ml sample, after dilution with water, with an excess of sodium formate on a hot plate for several hours. The sample is then evaporated almost to dryness and again diluted with water. The solution is filtered, and, after washing the filter, with the rhodium in the form of a fine black powder, is ignited in a porcelain crucible. After reduction in hydrogen, the metal is weighed.

For the determination of the sulfuric acid, a 5-ml sample is diluted with water and 10-ml hydrochloric acid are added. After addition of a barium chloride solution, the precipitated barium sulfate is filtered, washed, ignited, and weighed.

In a phosphoric acid bath, the specific gravity will give a fairly accurate measure of the amount of acid present.

Palladium is also weighed as metal, after reduction with sodium formate. The procedure follows that given for rhodium.

The determinations of chloride and nitrite follow the standard titrimetric procedures.

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project no. 2

project director:
EARL J. SERFASS*

associates:
MARY H. PERRY*

location:
LEHIGH UNIVERSITY,
BETHLEHEM, PA.

Acknowledgment is due the Research Committee, Mr. William Tucker, Eastman Kodak Company, Chairman; the Research Directing Sub-Committee, Mr. B. C. Case, Hanson-Van Winkle-Munning Company and Dr. R. M. Wick, Bethlehem Steel Company, Chairman and Vice-Chairman, respectively; and the Project Committee, Dr. D. Gardner Foulke, Hanson-Van Winkle-Munning Company, Chairman, and Dr. Walter R. Meyer, Enthone, Inc., for their contributions to this project.

*AUTHOR

Determination of Impurities in Electroplating Solutions

XX. TRACES OF CHROMIUM IN ZINC PLATING BATHS

Introduction

The purpose of this investigation was to develop a rapid, accurate method for the determination of a very small amount of chromate ion in zinc plating baths which also may contain copper, cobalt, nickel, ferric ion, and lead as impurities.

Although there are many references in the analytical literature pertaining to colorimetric methods for the determination of the chromate ion found in ores and steels, there is little information concerning colorimetric methods for the chromate determination in plating baths. The diphenylcarbazide method for chromate chromium in nickel and copper plating baths was suggested by Foulke[1] and also used in the methods developed by Serfass and coworkers.

The reaction between hexavalent chromium and diphenylcarbazide was chosen as the basis for the colorimetric method for determining chromium in zinc plating baths[1,3,10,11]. As stated by Serfass and Levine[10], the method has the following advantages:

1. The reaction between diphenylcarbazide and hexavalent chromium forms a red-violet colored product and is very sensitive.
2. There are comparatively few other elements that form intensely colored compounds with the reagent: Mo^{+6}, Hg^{+1}, Hg^{+2}, Fe^{+3}, and V^{+5}.
3. The color is developed in a dilute solution of mineral acid, usually sulfuric, with no buffers, complexing agents, or extractions.

In addition to the diphenylcarbazide method, there are several other methods found in the literature for the determination of chromium. The yellow color of the chromate ion in alkaline solution forms the basis of one common method when the amount of chromium present is not too small[2,3,6,11]. Also, the amount of chromium can be determined by measuring the intensity of the dichromate ion in acid solution[3]; again the amount of chromium present cannot be too small. Still another method depends upon the reaction of hexavalent chromium with disodium 1, 8-dihydroxynaphthalene-3, 6-disulfonate to form a pink to red color[4,7].

Most of the methods developed for chromium are divided into two parts: (a) determination of chromate ion and (b) determination of total chromium. However, in this investigation only a method for the determination of chromate ion had to be devised as no chromic ion Cr^{+3} would exist in zinc cyanide plating baths, which are alkaline and would precipitate $Cr(OH)_3$.

It should be mentioned that addition agents may be present in zinc cyanide plating baths that would reduce the chromate chromium to trivalent chromium, resulting in a colloidal suspension. Therefore, if the total chromium result is desired, it may be obtained by following the total chromium procedure in either the paper entitled "Traces of Chromium in Nickel Plating Baths[10]", or "Traces of Chromium in Copper Plating Baths[12]". The total chromium obtained by these methods include not only the Cr^{+3} in solution but also the $Cr(OH)_3$ present in colloidal suspension.

Determination of Chromate Chromium

Developmental Work

Since the conditions under which the chromate ion reacts with diphenylcarbazide are well known, the only problem requiring study was the possible inter-

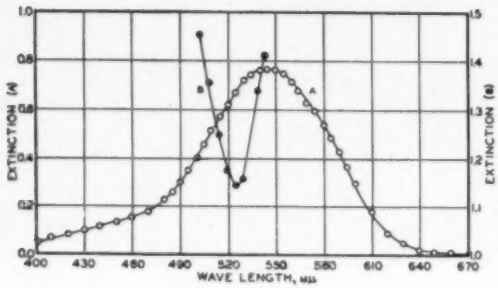

Fig. 1. Extinction vs. wavelength for (A) chromate-diphenylcarbazide complex of 50 micrograms chromic acid per 25 ml of solution, (B) Klett-Summerson green filter No. 54 (extinction units on the right)

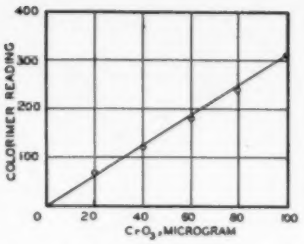

Fig. 2. Calibration curve for determination of chromate chromium (in terms of chromic trioxide) in zinc plating baths by the diphenylcarbazide method. Instrument used: Klett-Summerson colorimeter with green filter No. 54. Final volume of solution: 50 ml

ference by zinc or by impurities that may be present in the plating bath.

It is well known that iron causes interference in the diphenylcarbazide method. It is also well known that if either a green filter or a wave length of 460 mμ or higher is used, iron interferes very little. Even twenty times as much iron as chromium will not interfere if a wave length of 540 mμ is used. Since the impure bath would probably not contain over 2 g/l, the presence of iron should give no trouble.

With the first impure zinc bath that was prepared (1 g/l of Cu, Ni, Co, Fe^{+2}, and Pb), the same reading was not obtained as with the pure zinc bath. Therefore, one of the above impurities must cause some interference with the diphenylcarbazide method. By trying these impurities separately in the zinc baths, it was found that the copper caused the interference. By decreasing the amount of copper, the readings for the chromium in the pure and impure zinc baths became the same. It was found that 0.4 g/l of copper caused no interference in the method. This was considered to be within the amount of copper impurity allowed in the impure zinc bath. It is thought that copper chromate is formed when the solution is basic, and that when the solution is made acidic, not all the copper chromate is redissolved, thus lowering the reading on the colorimeter.

Preaparation of the Calibration Curve

To prepare the calibration curve, 1 ml of the pure zinc cyanide plating bath described in the "Recommended Routine Procedure" is pipetted into each of six 50-ml volumetric flasks, and 0, 10, 20, 30, 40, and 50 micrograms of CrO_3 are added as potassium dichromate to each flask respectively. Three drops of nitric acid and 15 ml of water are added. The flasks are shaken, and 2 ml of 0.25 per cent diphenylcarbazide solution are added followed by 1 ml of 6-*N* H_2SO_4, and the solutions are diluted to the mark with pure distilled water.

With distilled water as the reference liquid, the transmittancy of each solution is measured using a Klett-Summerson colorimeter with the green filter No. 54. This filter was selected because its maximum absorption band coincides with that of the chromate diphenylcarbazide colored system. The transmittancy curves for the filter and the chromate-carbazide system are shown in Fig. 2, curves A and B. The data were obtained with a Beckman spectrophotometer.

The data for the calibration curve are shown in Table I.

By plotting the corrected average readings against the corresponding amounts of CrO_3, the curve shown in Fig. 2 is obtained. The resulting straight line indicates that the Bouguer-Beer's Law is obeyed in the concentration range tested.

Recommended Routine Procedure

Solutions Required

1. Standard CrO_3 solution—10 micrograms/ml
   Dissolve 147 milligrams of pure potassium dichromate in 1 liter of pure distilled water by filling a liter flask to the mark. Take 10 ml of the stock solution and dilute to 100 ml in a 100-ml volumetric flask by adding distilled water to the mark.
2. Standard pure plating bath
   Dissolve 60 g $Zn(CN)_2$ (reagent quality), 22 g of NaCN and 52 g of NaOH in distilled water and fill to the mark of a 1-liter flask. Filter off the zinc hydroxide that is formed.
3. Diphenylcarbazidesolution—0.25 per cent
   Dissolve 0.25 g of the reagent in 100 ml of absolute alcohol. Prepare the reagent fresh every day. When the solution turns red, it has deteriorated and must be thrown away.
4. Sulfuric acid—approximately 4*N*
   Dilute 10 ml of concentrated H_2SO_4 to 60 ml with pure distilled water.
5. Nitric acid—cp concentrated

Apparatus Required

1. Pipettes
2. 50-, 100-, 1000- ml volumetric flasks
3. Klett-Summerson Colorimeter with green No. 54 filter or any spectrophotometer set at 520 mμ

Procedure

1. Using a pipette, add 1 ml of the bath

TABLE I. CALIBRATION CURVE FOR CHROMATE CHROMIUM

CrO_3 microgram	Colorimeter Readings	Average Reading	Blank	Corrected Average Reading
0	5, 5, 6	5	5	..
10	35, 35, 34	35	5	30
20	65, 60, 56	60	5	55
40	122, 120, 119	120	5	115
60	176, 174, 175	175	5	170
80	242, 240, 240	240	5	235
100	320, 325, 315	320	5	315

TABLE II. KIND AND QUANTITY OF IMPURITIES ADDED TO PURE BATH

Ion	Quantity mg/100 ml	Concentration g/l
Copper	40	0.4
Lead	50	0.5
Nickel	100	1.0
Iron (Fe^{+2})	100	1.0
Cobalt	100	1.0

to be analyzed into a 50-ml volumetric flask.

2. Add 3 drops of concentrated nitric acid from a dropping bottle or a dropper, and shake the solution well for about a minute. Then add 15 ml of water.
3. Add 2 ml of diphenylcarbazide solution and shake for a minute.
4. Add 1 ml of 6-*N* H_2SO_4 and shake the flask until the color becomes intense.
5. Using distilled water as reference liquid, measure the transmittancy of the solution and take the maximum reading attained if the pointer shifts slightly. Take reading immediately after color development.
6. Add 2 ml of diphenylcarbazide solution to 1 ml of the standard pure zinc cyanide solution fill (reagent 2), fill to the mark in a 50-ml volumetric flask, and make a reading. Subtract this blank reading from the sample reading.
7. Look up the corrected scale reading on the calibration curve; the amount of CrO_3 corresponding to it is the quantity of CrO_3 in the volume of the bath originally taken for analysis.

Calculations

In the chromate method, the element is in the hexavalent state and all calculations are reported in terms of CrO_3 content in mg/ml, ppm, or g/l.

In determining the chromate concentration subtract the blank from the colorimetric reading. Next, determine the concentration of CrO_3 this represents by checking with the calibration curve. Since 1 ml of the bath has been taken, there is the following relationship:

micrograms in 1 ml sample taken = milligrams of CrO_3 per liter of bath or ppm of CrO_3

Since the chromate-diphenylcarbazide colored system follows Bouguer-Beer's Law, the concentration of CrO_3 in an unknown can be determined without the use of a calibration curve by the application of the equation:

$$\frac{\text{conc. of standard}}{\text{corrected scale reading of standard}} \times \text{corrected reading of unkown} = \text{concentration of unknown}$$

This equation can only be applied when the instrument used measures transmittancy in terms of extinction or in units proportional to the extinction.

TABLE III. ACCURACY AND PRECISION DATA

CrO_3 Added microgram	Corrected Reading	CrO_3 Found microgram	Error microgram	Error per cent
20	55	20	0	0
40	110	38	2	−5
60	175	61	1	+1.7
80	234	79	1	−1.3
100	316	100	0	0
100	320	102	2	+2
100	315	100	0	0
100	318	101	1	+1

Accuracy and Precision of the Method

In order to check the accuracy and precision of this chromate method under conditions comparable to those found in commercial work, small amounts of various ions were dissolved in 100 ml of pure zinc cyanide bath, and the accuracy and precision were determined in the presence of these impurities. Table II shows the ions and the quantity of each that were added to the bath.

The nickel and copper ions were added as chlorides, the lead, cobalt and ferric ions as nitrates. After the impurities had been added, the mixture was heated, shaken well, and cooled. It was then filtered to remove the insoluble basic salts, and the filtrate was used for the tests.

Table III shows the accuracy and precision obtained by means of the procedure for the determination of chromate ion. The average error is 1.4 per cent, the maximum error 5 per cent.

An additional check of the accuracy of this procedure was made by sending samples of a test solution to several industrial concerns for analysis. The organizations which kindly consented to test the methods were: Poor and Company, Waukegan, Ill.; Republic Steel Corporation, Cleveland, Ohio; and Westinghouse Electric Corporation, East Pittsburgh, Pa.

The results obtained by these companies and the writers are shown in Table IV.

TABLE IV. RESULTS BY CO-OPERATING LABORATORIES

Laboratory	CrO_3 Found ppm
A	68.2
B	64.5
C	70.0
D	72.0

"Stop and Go" Method

For those who want a visual-comparison method for determining chromate ion in zinc cyanide baths, the following is recommended:

1. Develop the color in the unknown and in a blank in the manner described in the "Recommended Routine Procedure".
2. Transfer the solutions in the 50-ml flasks to Nessler tubes. The tube for the blank should be filled to about 45 ml.
3. Add standard chromate solution from a burette to the blank with thorough mixing following each addition until the colors of the solutions in the tubes match when viewed transversely against a white background. The unknown then contains as much CrO_3 as is added to the blank solution.

Applicability to Other Types of Zinc Baths

The procedure given for the determination of the chromate ion in zinc cyanide plating baths can be applied without change to zinc sulfate baths. Total chromium can also be determined in zinc sulfate baths by following the procedure given for its determination in nickel plating baths[11] or copper plating baths[12].

Summary

A method for the determination of chromate ion in zinc baths has been developed. An aliquot of the chromate solution is transferred to a volumetric flask, a few drops of nitric acid added to oxidize any reducing agents, diphenylcarbazide is added, and the acidity is adjusted with 6-*N* H_2SO_4 so that the final solution will be approximately 0.2 *N*. The transmittancy of the solution is measured, and the amount of CrO_3 is determined from a calibration curve.

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Book Review

DR. HAROLD J. READ
Associate Professor of Metallurgy, Pennsylvania State College

CHEMICAL ENGINEERS' HANDBOOK, edited by John H. Perry, 3rd revised edition, 1950, xv + 1942 pages. McGraw-Hill Book Company, Inc., 330 W. 42nd Street, New York 18, N. Y. Price, $15.00.

There is no doubt that this tremendous compilation of information on chemical engineering practice will be exceedingly useful to anyone working in any field where chemical operations are involved. Even the reviewer, in his somewhat tarnished ivory tower of academic metallurgical activities, has found numerous occasions during the short time the book has been in his hands to consult it and, what is more important, to find usually the information which he needed.

The volume is divided into 30 sections which represent the distilled knowledge and background of 141 contributors—each a specialist in some phase of chemical engineering. With the exception of a few sections which are devoted almost exclusively to tabulated data, each major division of the book is usually organized according to a plan which involves first the presentation of the theoretical and fundamental aspects of the subject, then a discussion of design problems and the approaches thereto, and finally descriptions of actual equipment and information on the selection of materials of construction. It will be seen that the Handbook is by no means limited to a mountain of tabulated and graphical information; in fact, the textual material is really very extensive. Most sections contain numerous references to the literature, both as general bibliographies at the beginning of the sections and as specific citations at pertinent places in the text.

Although the metal finisher will find the book very useful, it is likely that he will be disappointed in some portions of the volume. The section on electrochemistry is unsatisfactory in that there is too much sketchy theoretical material and too little *usable* practical information. There appears to be almost nothing which would be of much use in the design, construction, or operation of any electrochemical equipment. Ventilation is a problem which is often encountered in metal finishing, as well as in other phases of chemical engineering, but only a half-page is devoted to this subject.

Those who are familiar with the older editions may miss the sections on report writing, indicators, qualitative analysis, and organic chemistry which have been deleted in the 3rd edition to make room for new chapters on diffusion, furnaces and kilns, size enlargement, distillation (3 sections) and dialysis. The new sections are valuable additions and are more fitting to the general character of the volume than those they displaced.

Mirror-Bright

(*Continued from page 1044*)

room temperature over a period of 25–30 minutes. It was then heated carefully to 80° C over a period of 20 minutes, kept at 80° ± 2° C for a period of 1 hour, and cooled.

The sulfonation of the di-p-tolyl disulfide requires considerable care to produce a satisfactory product. The material should be sulfonated shortly before it is to be used, since the concentrated mixture appears to be unstable on storage.

ACKNOWLEDGMENT

The authors acknowledge with appreciation the permission of the Houdaille-Hershey Corporation (for which the research was conducted) and of Battelle Memorial Institute (where the work was carried out) to publish this paper.

CONTINUATION

Part II of this paper will follow shortly. It discusses the results of pilot-plant operation of 100-gallon plating baths for both bright- and semibright-copper plate.

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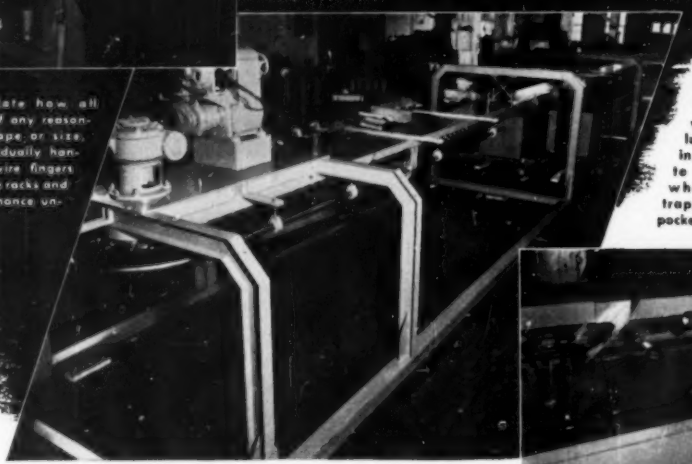

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——readers' questions of general interest——

Q. 97. In order to facilitate the brazing of small steel (A. I. S. I. 1146) part to a cast iron body with a brass ring, we have been immersion plating the steel part in an acid copper sulfate solution. In small quantities the parts are coated with a bright adherent deposit. However, in the large quantities which we desire to dip, the parts either do not coat at all or the copper coating is very dark and nonadherent. Your comments and suggestions on the bath composition and method of procedure will be greatly appreciated.

A. We suggest that you try the Cuprodine solution marketed by American Chemical Paint Company, Ambler, Pa., which in many places has replaced the usual acid copper sulfate solution for coppering prior to wire drawing.—K. G. SODERBERG.

Q. 98. We operate a 1500-gallon tin solution containing 16.1 oz/gal sodium stannate (6.5 oz/gal tin), 16.8 oz/gal carbonates, and 2.4 oz/gal caustic at 10 asf with an anode-cathode area ratio of 1:2. The work hangs about 8 inches from the anodes. We have had some complaints that the tin has come off very fast in the areas nearest the anodes. Your advice would be appreciated.

A. The questioner does not give sufficient information about the conditions surrounding his difficulties. However, for a starter, I would suggest that he try either a higher or a lower temperature in the plating bath. If he is operating around 70° C (158° F), he should raise the temperature by 10–15° C (18–27° F); if he is operating around 90° C (194° F), he should lower the temperature by 10–15° C. This procedure will change the cathode efficiency and thus change the deposit.—C. J. WERNLUND.

Q. 99. We wish to tip a mining drill with bits of special steel. We have heard that this is done by copper plating both the bit and the inside crevice into which it will fit and then fusing them together with high-frequency current. Can this be done without raising the temperature of the cutting bit above 900° C, at which temperature the steel changes its properties?

A. Copper brazing is usually done in a hydrogen atmosphere, and hence high-frequency equipment does not lend itself to this job as well as other types of furnaces. Temperatures are higher than 900° C to flow the copper—HENRY M. ROWAN.

A. According to Hodgman, "Handbook of Chemistry and Physics", a 55–45 copper-zinc alloy (by weight) fuses at 880° C and is used for brazing iron, copper and brass with borax as the commonly used flux. It should be possible to deposit this brass alloy from a modified brass plating solution.—K. G. SODERBERG.

Q. 100. We experience onsiderable difficulty with cyanide spotting on cast-iron and red-brass castings that have been brass plated and buffed to a high lustre. What can you recommend?

A. We suggest that you study carefully the article, "Plating of Pressed Metal Powder Parts" by Graham, Pinkerton, Anderson and Reinhard, which appeared in the July, 1949 issue of PLATING. It discusses such remedies as electrorinsing and alternate hot-and-cold rinsing, neutralization with citric acid, dewatering and subsequent degreasing, and pore-filling with metal in suitable plating baths. The latter subject is discussed further in the paper by Reinhard, "Some Observations of the Microthrowing Power of Plating Solutions", to be published in the 1950 *Proceedings* of the American Electroplaters' Society. This paper indicates that pores are better filled by plating with acid solutions (copper, zinc, nickel) than by plating with cyanide solutions (copper, zinc), especially if the former are operated with high metal content and at low current density. Such solutions may be tried for preplating prior to brass plating.—A. K. GRAHAM.

Q. 101. Can you give me any information relative to the use of barium peroxide for reduction of the trivalent chromium content of chromium plating solutions? Would it not be equivalent to using hydrogen peroxide, except that barium would precipitate the sulfate?

A. In our experience, peroxides reduce chromic acid and raise the trivalent chromium content. Barium ions precipitate first sulfate and then, if present in sufficient quantity, chromate.

Potassium permanganate will oxidize trivalent chromium present in sulfate-chromate solution, but whether complications result from its use in chromium plating baths we do not know.

The standard method of anodic oxidation at peroxidized lead anodes is discussed in a paper by Seegmiller and Lamb in the *Proceedings* of the American Electroplaters' Society, 1948.—K. G. SODERBERG.

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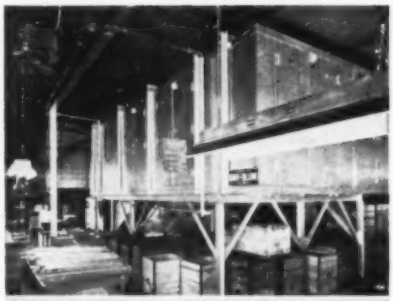

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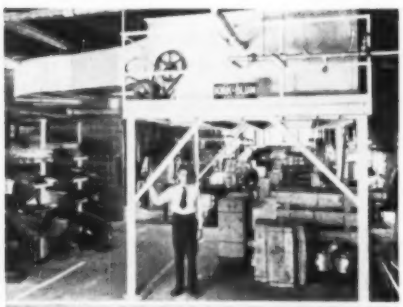

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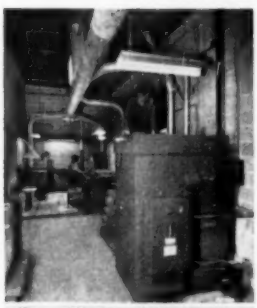
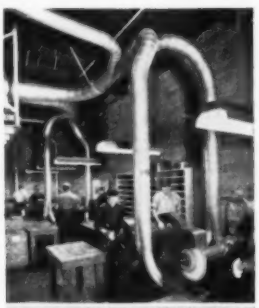
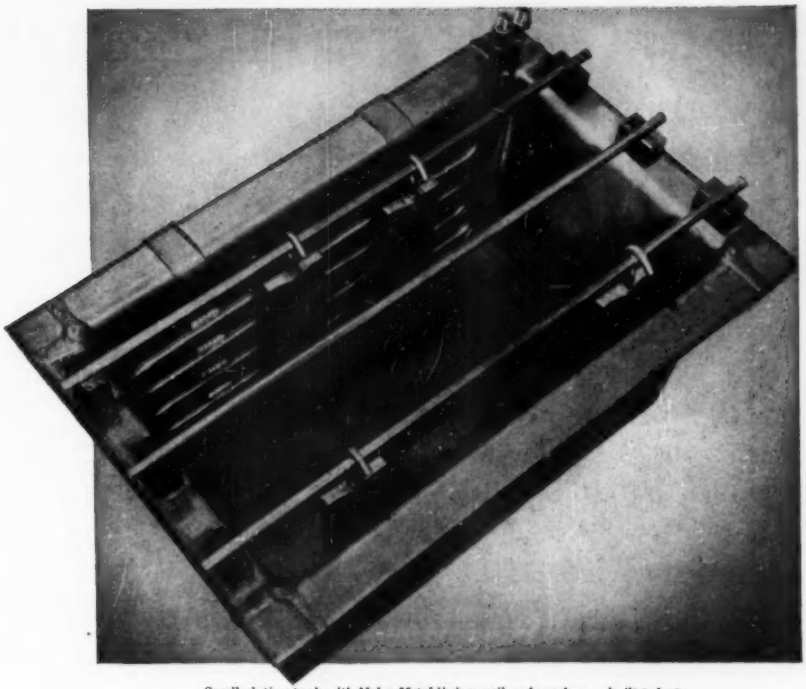


Fume Removal System in the Acid Etching and Degreasing department.



Two KIRK & BLUM Dust Control Systems serve the polishing and buffing room.



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Article Abstracts

For copies of original articles, turn to your Public Library for photostats or addresses of the publications in question

The Electrolytic Estimation of Cadmium from Sulfuric or Perchloric Acid Solutions. G. H. Osborn. Metallurgia **40**, 111–113 (June, 1949).
Present methods for the electrodeposition of cadmium for analytical purposes are reviewed and critically discussed. None result in an ideal deposit, and a modification is suggested by which it is possible to obtain quantitative results and a firm bright deposit. The method gives complete separation from nickel, zinc, and copper. Bismuth, if present, would codeposit but is said to be a rare contaminant. 15 ref.

Effect of Chromium Plating on the Endurance Limit of Steels Used in Aircraft. Hugh L. Logan. J. Research Natl. Bur. Stds. **43**, 101–112 (August, (1949).
Chromium plating reduced endurance limits of both normalized and hardened SAE X4130 steels; reduction was larger for the hardened steel. Endurance limits for steel of given hardness decreased with increased plating-bath temperatures. Baking at temperatures up to 350° C (660° F) reduced the endurance limit; baking at 440° C (824° F) increased the limit for plated steel. Damaging effects of chromium are attributed to stresses which are increased by low-temperature baking, but are relieved in part by baking at 400–440° C (750–824° F). 14 ref.

A New Method for Surface Reproduction. K. B. Mather. Metal Progress **56**, 225–227 (August, 1949).
If a reasonably flat metal surface is pressed into a fine-grained photographic emulsion at about 15,000 psi and the plate is developed and examined under a microscope, a pattern is found that reproduces the surface contours. A pronounced three-dimensional appearance results. If standardized, it is believed that the method might give a quantitative measure of surface roughness. Results are illustrated.

New SAE Finish Standard Aims To Help Engineer and Shop Man. Anon. SAE Journal **57**, 33–38 (July, 1949).
Summarizes the above and its use. Includes diagrams, tables, and photomicrographs. The Standard is published in the 1949 SAE Handbook.

Methods of Plating Zinc Base Diecastings. Robert Buckley. Materials & Methods **31**, 53–55 (March, 1950).
Design, careful surface preparation, and proper plating cycle are described as being important factors in the plating of zinc-base diecastings. After discussing those factors, the author presents a plating cycle for zinc diecastings that includes precleaning, electro-

cleaning, acid dip, copper plate, acid dip, copper plate, acid dip, nickel plate, and chromium plate. Direct plating of nickel on zinc parts and barrel plating are also discussed. A. S. T. M. tentative specifications for thickness of electrodeposited coatings on zinc diecastings accompany the article.

Surface Preparation; New Studies on the Oxidation of Pure Aluminum. G. Chaudron and P. J. G. Lacombe. Metal Ind. **76**, 69–70 (January 27, 1950).
In studying the effect of the electrolytic polishing of high purity aluminum it was necessary to know whether the metal did or did not undergo oxidation in a specific electrolytic treatment and, if it did, at what stage oxidation occurred. The investigations are described briefly; curves are used to show results.

A Method for the Electrolytic Polishing and Etching of Some Aluminum-Silver Alloys, Commerical-Purity Aluminum, and Pure Magnesium. L. W. Larke and E. B. Wicks. Metallurgia **41**, 172–174 (January, 1950).
Difficulties having been encountered in the mechanical polishing and etching of aluminum-silver alloys, the authors developed a solution for the electrolytic polishing and etching of these alloys. Details are given, and reference is made to the use of the same solution for the polishing of commercial-purity aluminum and pure magnesium.

"Standard Grade" Hot-Dipped Galvanized Ware (Coated after Fabrication). Natl. Bur. Stds. Commercial Standard C5 161–49 (January, 1950). 11 pp.
The purpose of this commercial standard is to establish minimum essential requirements for material, workmanship, and construction of the articles of hot-dipped galvanized ware. Requirements are covered for base metal, coating, and important features of construction.

Electroforming Adapted to Aviation. G. C. Close. Aviation Operations **31**, 62 (February, 1950).
Electroforming, or "cold casting", promises to do some of the most critical metal construction jobs, many of which have to do with aircraft and aircraft acces-

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sories. One feature of the process, its ability to produce high dimensional accuracy and fine internal finishes, has adapted it to the production of such critical parts as radar wave guides, jet-airplane venturi tubes, and components for ramjet-engine injectors. Computing-pin cams and three-dimensional cams are other electroforming developments. Electroforming of molds for plastic-laminate aircraft components is gaining rapid prominence. The electroforming process lends itself very well to mass-production methods. The by-products of this process will be of interest to salvage engineers. Full exploitation of this process will not be accomplished for many years, but controlled dissemination of knowledge concerning the process, word of what has already been accomplished, and data that can be used in adapting it to new uses will be of great value to design engineers.

Penetration of Sintered Metals by Solutions of Surface-Active Agents. A. J. Finks and N. J. Petito. Anal. Chem. **21,** 1101–1102 (September, 1949).
Describes method which indicates the comparative wetting and penetrating qualities of surface-active agents. Gives data resulting from its application to stainless-steel filter elements of varying porosities. Suggests application to other metals, glass, fabrics, etc., and for research on metal cleaning or lubrication.

Hydrofluoric Acid Versus Construction Materials. Anon. Chem. Eng. **56,** 229–230 (September, 1949).
Part II of a symposium in which a representative group of construction materials are evaluated. Consists of the following: "Stainless Steel", W. G. Renshaw; "Hastelloy Alloys", C. G. Chisholm; and "Iron and Steel", A. W. Spitz.

Ediphone Standardized Plating Racks. P. B. Kasakove. Iron Age **164,** 82–83 (September, 1949).
Describes and illustrates four standardized racks used in plating over 500 different parts made of copper, brass, steel, zinc, and aluminum.

Rapid Method for Determining Nickel on the Surface of Enameling Iron. L. C. Ikenberry and J. J. Canfield. J. Am. Ceramic Soc. **32,** 308–312 (October, 1949).
Describes method requiring less than five minutes. Standard deviation was found to be 0.0028 g of nickel per sq.ft when testing a sheet carrying 0.10 g per sq.ft.

Properties of Conductive Plastics. Electronics **22,** 96–99 (October, 1949).
Describes new conductive materials which can be molded like ordinary plastics, yet have electrical resistivities approaching that of mercury. Many can be soldered or electroplated directly. Promising applications include shielding, molded circuits, resistors, and commutators.

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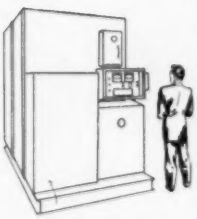

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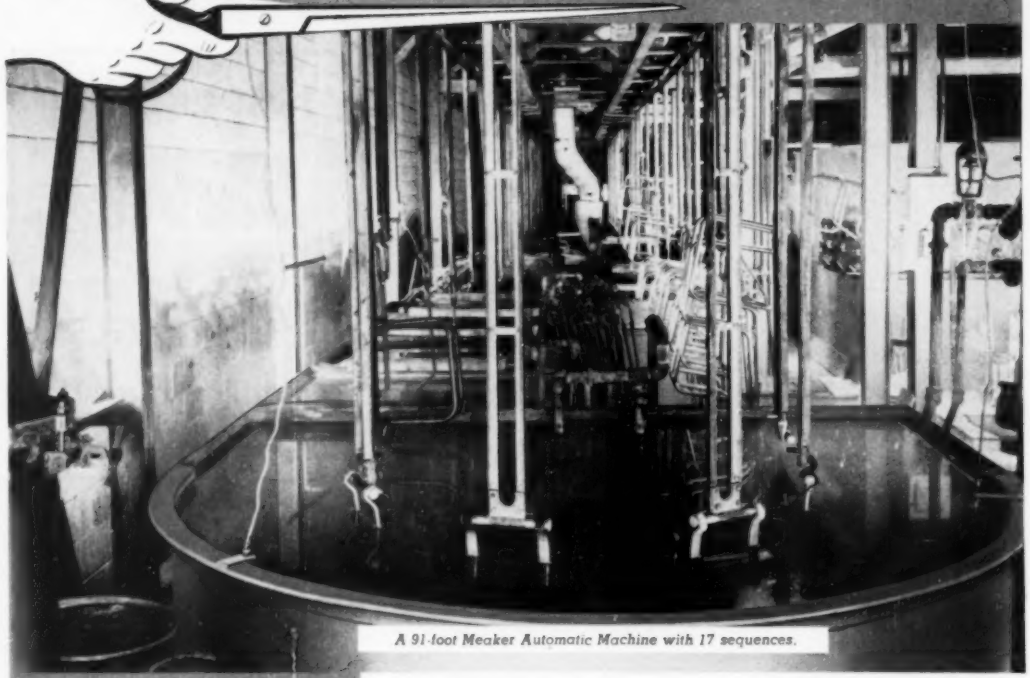

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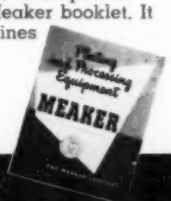

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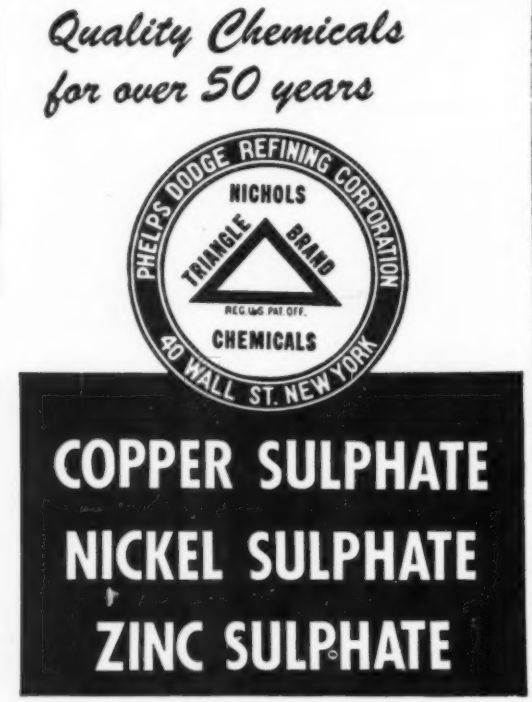

Patent Abstracts

GEORGE B. HOGABOOM

Consultant, New Britain, Conn.

Copies of patents may be obtained by writing to Commissioner of Patents, Washington 25, D.C. Price 25 cents each.

No. 2,496,845, February 7, 1950—Bath for Brass Immersion on Aluminum and Aluminum Alloy—Alvin R. Balden and Leland M. Morse, assignors to Chrysler Corporation, Detroit, Mich.

We have found that the presence of critical amounts of lead salts in brass immersion-coating baths from which brass is deposited by chemical displacement produces coatings on aluminum and aluminum-alloy surfaces which are extremely adherent to such surfaces and have excellent bearing properties. It has also been found that the appearance of the resulting coatings can be controlled within ranges of color varying from pink through yellow to green by suitable control of the lead-salt content of the bath. The thickness characteristics of the resulting deposit can correspondingly be controlled by the lead-salt content of the bath. When the lead-salt content is such as to produce a pink deposit, the coating can be built upon aluminum and aluminum-alloy surfaces to a greater thickness than those of yellow and green deposits, the yellow deposit being capable of being built up to a greater thickness than the green . . . a coating (of generally yellow coloration) of approximately 0.0001 inch to 0.00015 inch thickness is produced on such aluminum alloys (high alloy content) by an immersion time of about five minutes.

CLAIM 2. A bath for depositing a brass coating by chemical displacement on aluminum alloy of the class which includes the order of 6.25 per cent to 7.75 per cent copper, 5 per cent to 6 per cent silicon, 0.1 per cent to 0.40 per cent magnesium, up to 1.5 per cent iron, up to 0.75 per cent impurities including zinc, and the remainder aluminum, comprising approximately 15.8 oz per gallon of sodium zincate, 16.2 oz per gallon of sodium hydroxide, 1.75 oz per gallon of copper cyanide, 3.17 oz per gallon of sodium cyanide and an amount of lead salt soluble in caustic solution and equivalent to 0.014 oz per gallon of basic lead carbonate.

8 claims.

References cited: U. S. Patents 1,947,981; 2,086,841; 2,230,602. Meyer et al., Electrochemical Society Preprints 73, pp. 299, 300, 312, 314, 320, 321 (1938).

No. 2,513,280, July 4, 1950—Electrodeposition of Nickel from an Acid Bath—Henry Brown, assignor to The Udylite Corporation.

Examples of preferred bright plating bath composition are listed under Examples A, B, C. Bath C is

used for highest current density plating, and also where highest anode current densities are wanted.

EXAMPLE A

$NiSO_4 . 6H_2O$, g/l	200–300
$NiCl_2 . 6H_2O$, g/l	125–45
o-benzoyl sulfimide, g/l	1–2
p-toluene sulfonamide, g/l	1
N-methyl acetate-4-nitro-5 (-3′-pyridinium pyrazole chloride)	0.002–0.006
Temperature, °F	110–140
*p*H	3–5.0

EXAMPLE B

$NiSO_4 . 6H_2O$, g/l	300
$NiCl_2 . 6H_2O$, g/l	45–60
H_3BO_3, g/l	40
p-toluene sulfonamide, g/l	2
N-acetic acid-4-nitro-5 (-3′-pyridinium pyrazole chloride), g/l	0.003
α, α, β-trichlorobutyraldehyde hydrate, g/l	0.3–0.7
Temperature, °F	110–140
*p*H	3.0–5.0

EXAMPLE C

$NiSO_4 . 6H_2O$, g/l	75
$NiCl_2 . 6H_2O$, g/l	300
H_3BO_3, g/l	40
o-benzoyl sulfimide, g/l	1–2
Sodium p-toluene sulfinate, g/l	0.02
E-ethanol-4-nitro-5 (-3′-pyridinium pyrazole chloride), g/l	0.003–0.004
α, α, β-trichlorobutyraldehyde hydrate	0.3–0.7
Temperature, °F	110–140
*p*H	3–4.8

The best cathode film buffer is boric acid, and it should be used in all of the acidic nickel baths for best results, even if it is desired to use other buffers beside. Nickel citrate and nickel formate can be used, for example, though if they are used, it is preferred to use them in conjunction with boric acid. Nickel fluoborate and fluoboric acid as buffers are best toward the higher *p*H values, i. e., 5–5.5, and are exceptional in preventing burning.

To prevent pitting, air agitation or compatible wetting agents which do not interfere with the ductility of the plate or the bright plating range are used.

CLAIM 1. A bath for electrodepositing bright nickel comprising an aqueous acid solution comprising essentially a material selected from the group consisting of nickel chloride, nickel sulfate, a mixture of nickel sulfate and nickel chloride, a mixture of nickel sulfamate and nickel chloride, a mixture of nickel fluoborate and nickel chloride, a mixture of nickel fluoborate and nickel sulfate, a mixture of nickel sulfate, nickel chloride and nickel fluoborate, and a mixture of nickel fluoborate and nickel sulfamate, said solution also

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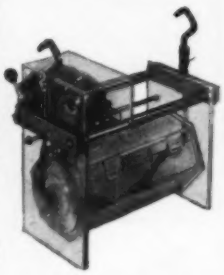

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containing an organic pyrazole compound soluble in the solution selected from the group consisting of N-alkyl (from one to six carbon atoms) pyridinium pyrazoles and quinolinium pyrazoles together with an aryl compound soluble in the bath and selected from the group consisting of benzene sulfonamides, benzene sulfonic acids, and naphthalene sulfonic acids, said organic pyrazole compound being dissolved in the solution in a concentration falling within a range of from .001 to .02 gram per liter of solution and said aryl compound being dissolved in said solution in a concentration falling within a range of from .02 gram per liter of solution to saturation.

4 claims.

References cited: U. S. Patents 2,238,861; 2,255,057; 2,315,802; 2,402,801. Ind. Eng. Chem. **33**, 1546, 1547 (1941).

No. 2,515,192, July 18, 1950—Method of Electroplating—A. E. Chester, assignor to Poor & Company, Chicago, Ill.

CLAIM 1. In a method of controlling the electrodeposition of antimony from an antimony trichloride plating bath onto an electrically conducting object of a type in which the antimony would normally be deposited in greater concentrations in some areas than in others by a direct plating current, the step comprising electrodepositing antimony from an antimony trichloride plating bath by subjecting said object as a cathode in the plating bath to a plating current having an asymmetric alternating wave form comprising an alternating current superimposed on a direct current in the ratio of 2–4 volts R.M.S. to 2.5 volts D.C. regardless of the specific current values, at current densities from about 2 to about 15 amperes per square foot.

CLAIM 2. . . . for a period of time within the range of 8 seconds to about 1½ minutes.

Legend

EXAMPLE I

In one gallon of commercial 18° Bé hydrochloric acid, there were dissolved

6 ounces of antimony chloride (Sb_2O_3)
2 ounces of arsenic trioxide (As_2O_3)
½ ounce of metallic selenium, and
1/10 percent, based on the total weight of the mixture, of lauryl sulfate

EXAMPLE III

A typical composition for an alkaline bath is the following:

4.4 ounces of potassium carbonate
2.11 ounces of antimony sulfide (Sb_2S_3)
1 quart of water

A cold-rolled steel anode is preferred

References cited: U. S. Patents 792,307; 1,918,605; 2,063,760; 2,401,738; 2,443,599. Trans. Faraday Soc. **24**, 348–358 (1928); **18**, 102–111 (1922). Monthly Rev. Am. Electroplaters' Soc. **31**, 168 (1944). Trans. Electrochem. Soc. **41**, 151–180 (1922).

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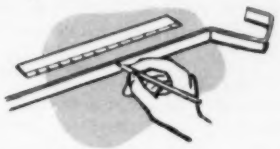
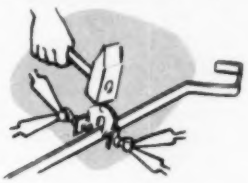
Eliminates expensive shop time used to bore and adjust splines

all you have to do is:



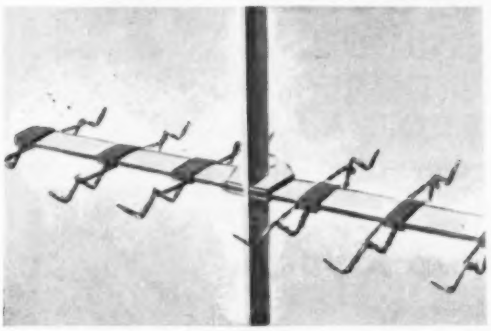
1 Measure and mark Spline

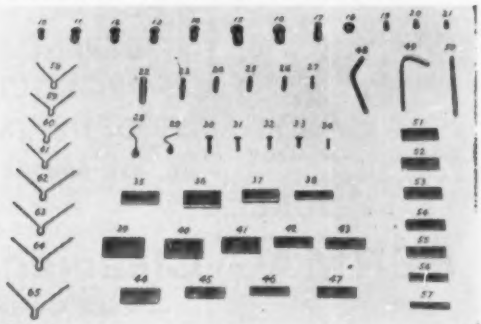


2 Drive-on STANDARD Saddle Tips *

*Patent applied for.

SAVES TIME...SAVES MONEY...HOLDS FIRM





Rides the Spline like a Cowboy

Standard Plating Rack Company

1913-25 N. PAULINA STREET, CHICAGO 22, ILL.
Phone: ARmitage 6-6766

The most modern and efficient rack producing plant in the world
WE CAN FURNISH PARTS FOR YOUR ASSEMBLY OUT OF STOCK

MAIL THE HANDY COUPON NOW FOR MORE INFORMATION

STANDARD PLATING RACK CO. *P
1913-25 N. Paulina Street, Chicago 22, Illinois

Gentlemen: Yes, I am interested in STANDARD SADDLE TIPS. Please have your sales representative call, with a sample of this new—easy-to-use drive on Saddle Tip at no obligation to me.

Name .....

Company ..... Position .....

Address .....

City ..... State .....

Patent Abstracts

No. 2,520,703, August 29, 1950—Disposal of Waste Cyanide—Robert M. Wagner, assignor to General Motors Corporation.

All the prior methods (for disposing of waste cyanide from cyanide plating baths) of which I am aware are subject to one or more objections. I have found that the waste cyanide material can be treated by electrolyzing a heated solution of the cyanide-bearing material. . . . In one specific example involving a large amount of waste material from copper cyanide plating baths, a large tank was installed in the open to eliminate the need for an exhaust system. A steam coil was installed in the tank, and waste salts and solutions were dissolved in the tank. The solution temperature was maintained at 200° F and a generator having a voltage of about 13 volts connected across the tank with anodes and cathodes made of heavy expanded metal. It was found that under the above conditions, the cyanide concentrations could be reduced to less than four parts per million, which represents the limit of sensitivity of the distillation method of determination. The time required ranged from several hours to three or four days depending, of course, upon the original concentration of solution. Air agitation can be employed for the purpose of speeding up the process. By use of a suitable exhaust system the treatment can be carried out inside a building.

CLAIM 1. The process of treating waste cyanide material from metal cyanide plating baths which comprise passing an electric current from an insoluble anode to a cathode through an aqueous solution of waste cyanide material at a temperature of about 200° F until the metal and free cyanide are substantially zero and the solution is substantially nontoxic.

CLAIM 4. The process of treating the residue from the bottoms of metal cyanide plating baths which includes dissolving all the waste material possible in an aqueous solution in a tank and leaving some undissolved waste material on the bottom of said tank, heating said solution in the tank substantially to boiling temperature, and passing an electric current through said heated solution from an insoluble anode to a cathode until the metal and free cyanide are substantially zero, said undissolved waste material dissolving in said solution in the tank during the earlier stages of said current flow.

5 claims.

References cited: U. S. Patents 756,211; 1,531,863. Chem. Abs. **27**, 4741 (1933). Products Finishing **6**, 48 (February, 1942).

The TIME is NOW—Delay is a Risk!

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—Because of Performance

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Magnuson Products Corp.
Mfrs. of Specialized Cleaning Compounds for Industry
50 Court Street Brooklyn 2, N. Y.

In Canada: Canadian PERMAG Products, Ltd., Montreal, P. Q.

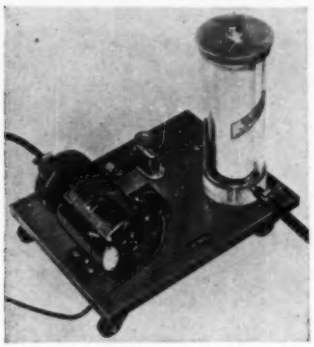
MAGNUSON PRODUCTS CORP.
50 Court St., Brooklyn 2, N. Y.

Please send FOLDER giving special details on PERMAG for the electroplaten at this time.

Title .....
Name .....
Firm .....
Address .....
City .....
State .....
Requirements .....

Equipment and Supplies

E—560. Filter—Sethco, 105–107 150th Street, Jamaica 4, N. Y., announces a new filter, Model LSI-10, equipped with high-temperature lucite filter cylinder and stainless-steel pump and rated 100 gph.



Advantages claimed are (1) complete resistance to all electroplating and industrial solutions, (2) solutions up to 200° F may be filtered, (3) less than 1 minute to start any filtration, (4) no loss of expensive solutions, (5) filter tube of specially processed cotton yarn wound around a stainless-steel supporting can be backwashed, (6) crystal clear filtrate, (7) progress of the filtration can be watched through transparent lucite cylinder. For further information, use Reader Service Card.

E—561. Hand Threader for "Karbate" Pipe—A hand-threading tool for use with "Karbate" impervious graphite pipe has been announced by National Carbon Division, Union Carbide and Carbon Corporation, 30 E. 42nd Street, New York 17, N. Y. The new, inexpensive tool is said to eliminate the need for an expensive lathe operation and is easy to carry, making it possible to cut, thread and install pipe right on the job. For further information, use Reader Service Card.

E—562. Roof Ventilator—De Bothezat Fans Division, American Machine and Metals, Inc., East Moline, Ill., is now in production on new style Vertical Discharge Roof Ventilators for industrial applications. These motor-driven ventilators are designed for use where harmful exhaust fumes must be disbursed into the air as high as possible above the roof. They are available with fan wheels 36, 42 and 48 inches in diameter and capacities up to 40,900 cfm of air and are said to be weatherproof at all times. For further information, use Reader Service Card.

E—563. Packaging of Sharpening Stones—Behr-Manning, Division of Norton Company, Troy, N. Y., has announced a new "Service Packaging" of its Norton Abrasives sharpening Stone Line, which includes the adoption of standard label colors for each stone family, as for instance, brown for India®, red for Crystolon®, etc. In addition, the new wrap-around end label on individual boxes features what distributors and jobbers consider most important in order of prominence: (a) code number, (b) brand name, (c) size on the end area; and (d) quantity, (e) grit, (f) shape on the side area. For further information, use Reader Service Card.

E—564. Solid Rubber Core Wire Brush—With wires completely locked in a solid rubber core, the Skil "Flex" Wire Brush manufactured by Skilsaw, Inc., 5033 Elston Avenue, Chicago 30, Ill., is said to reduce the danger of flying bristles and to last four times longer than conventional brushes. The resilient rubber mounting allows the brush to be used right down to the core. Individual wires remain in upright position, keeping the maximum number of cutting points in contact with the work. For further information, use Reader Service Card.

E—565. Rinsing Aid—"Dri-Water" made by dissolving 1 oz "Blue Concentrate," a product of The Miskella Infra-Red Company, East 73rd and Grand Avenue, Cleveland 4, Ohio, in 10 gallons of water is said to shorten the drying time and reduce the heat needed for complete drying for further processing. Blowing off by compressed air is usually eliminated.

Solid objects made of glass, metals waxes, hard rubber, plastics, etc., when treated with Dri-Water show no droplets whatever, only a light, uniform coating of water, like a fog blown by one's breath. For further information, use Reader Service Card.

E—566. Current-less Stripper for Nickel, Lead, Tin and Chromium Coatings on Cooper Base Alloys.—Enthone, Inc., Dept. P, 442 Elm Street, New Haven, Conn., has announced a new product for the rapid stripping of nickel, tin, lead and chromium from copper, brass and other copper alloys without attack upon the base metal. The work to be stripped is immersed, without current, in an acid solution containing 1 lb/gal Metal Stripper N-165, a neutral powder said to be safe to handle. Stripping rates as high as 0.006 inch per hour of nickel have been obtained. The process is stated to be ideal for removal of nickel from bulk-plated work as well as from heavier plated objects, such as percolators, flashlights, plumbing goods, and other items made of copper. It is also suitable for rapid removal of nickel and chromium from tips of plating racks, thus reducing overall rack-maintenance cost.

Stripping can be done at room temperature or at higher temperatures if faster stripping is desired. The process is not suitable for removal of nickel from steel or zinc-base alloys. Enthone's Metal Stripper "A" is recommended for removal of nickel from steel without attack. For further information, use Reader Service Card.

E—567. Hard Gas-Carbon Anodes—When carbon anodes are required, it is necessary that pure, hard gas-carbon anodes be used. The carbon anodes made by the Hanson-Van Winkle-Munning Company, Matawan, N. J., are recommended for (1) black-nickel solutions operated at room temperature and at relatively high pH and (2) purification, when carbon anodes are employed as ready conductors of both heat and current. The standard-size carbon anode is 3/8 inch thick, 3 or 6 inches wide, and 12, 18 or 24 inches long. For further information, use Reader Service Card.

E—568. A-C Motor with Preset-Speed Device—Apparatus News Bureau, General Electric Company, Schenectady 5, N. Y., announces that the G. E. ACA (a-c adjustable-speed) motor is now available with a mechanical follow-up control for achieving a fixed preset speed without the use of expensive control equipment. The new device enables a predetermined speed to be set manually, by a knob either directly on the ACA motor or at the end of a flexible cable 10 or 15 feet away. The speed adjustment, which can be made while the motor is at a standstill or while it is running, is obtained by rotating the brushes around the commutator. In operation, the new mechanism actuates a pilot motor which drives the brushes to a position corresponding to the setting of the speed-adjustment knob. For further information, use Reader Service Card.

E—569. Rubber Work Shoe—Industrial Products Company, 2824 N. Fourth Street, Philadelphia 33, Pa., announces a new all-rubber work shoe (not an overshoe) designed for use in mines, chemical

plants, etc., where the conventional leather shoe is unsatisfactory. Made in blucher style, it is all black in color, has cushion insole, and is made with a steel shank for extra safety and wear. It is available in 6-inch regular shoe height and full range of sizes, with plain toe or steel

safety toe. For further information, use Reader Service Card.

E—570. Vaneaxial Fans—Robbins & Myers, Inc., Springfield 99, Ohio, announces the addition of two new vaneaxial-type medium-pressure propellor fans to its line. Designed for ductwork applica-

tions, the fans permit series or straight-through connections for all air-moving requirements. Supplementing aerodynamically engineered airfoil-section propellers, the guide vanes are said to prevent swirling and provide a smooth, efficient, axial flow of air. Operating on a low horsepower input, the units work quietly over a wide pressure range. Type VCDD direct-driven units, constructed with the motor inside the airstream, are suitable for nonhazardous applications. Type VCS belt-driven units for installations in which corrosive or inflammable fumes, dusts, or vapors must be considered. For further information, use Reader Service Card.

E—571. Hose for Hot Spray Finishing—A flexible hose which is reported to give exceptional service with hot spray lacquers is being offered by Resistoflex Corporation, Belleville 9, N. J.

Constructed with a tube of compar, which has outstanding resistance to strong solvents, the tube will not swell in contact with aromatic hydrocarbons, esters, ketones, or chlorinated solvents. The hose is also reported to have high-tensile-yarn reinforcing braids. Its synthetic cover is lead-mold cured for toughness and abrasion resistance. The hose is built in ¼-, 5/16-, ⅜-, and ½-inch diameters and is dimensionally suited for use with the reusable couplings on conventional spray equipment. For further information, use Reader Service Card.

E—572. Polishing Belt—The Industrial Lubricants Company, Inc., 14459 Wildemere, Detroit 6, Mich., has recently been appointed distributor for the new Rayon-Resin polishing belt, which for three years has been tested on the job in factories throughout the country. During these tests, these patented belts are said to have been used and reset in excess of 650 times and to be still in use without raveling and stretch and with shrinkage of less than 2 per cent. The pulley side is Neoprene, vulcanized to the rayon polishing side. A special splice is used to join the belt for smooth running. For further information, use Reader Service Card.

E—573. Motor Driven Trolley—Industrial Equipment Company, 315 N. Ada Street, Chicago 7, Ill., announces the Moto-Trolley, designed for attachment

to standard lug-mounted electric hoists and adjustable to a wide variety of beam sizes.

The Moto-Trolley has crown-tread machine-steel wheels with hardened drivers. Each wheel is equipped with double-row precision ball bearings and an Indus-

NOBLES
CENTRIFUGAL DRYER
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200%*

You can get results just as the Warsaw Plating Co. did by a simple conversion to NOBLES CENTRIFUGAL DRYER.

Features
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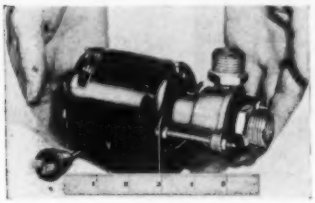
Write for more information.

NOBLES ENGINEERING & MANUFACTURING CO.
745 EAST THIRD ST. ST. PAUL 6, MINNESOTA

trial removable-head axle fitted with Alemite grease fittings. The trolley is powered by a crane-duty high-torque totally enclosed motor of 30 minute, 55° rating. The magnetic-contact panel is equipped with a transformer to reduce the voltage in the single-speed push-button control circuit. A four-button control station is provided to operate the single-speed trolley and hoist motions. For further information, use Reader Service Card.

E—574. Small Pump—Samuel S. Gelber Company, 162 N. Clinton Street, Chicago 6, Ill., announces a new high-



capacity small recirculating pump claimed to be more than twice as efficient as conventional centrifugal small pumps of the same horsepower, delivering 480 gph at 2-ft head and 180 gph at 10-ft head.

The whole body is of hydraulic bronze cast in one piece, and all interior surfaces are highly machined to mirror-like finish. The seal is made of Hycar synthetic rubber. As the water load increases, the seal load decreases. The characteristics of the fan-cooled motor are two-pole (shaded pole), 110-volts, 60-cycle ac, 1/50 and 1/30 hp. For further information, use Reader Service Card.

E—575. Extruded Zinc Anodes—Said to be offered only by the Hanson-Van Winkle-Munning Company, Matawan, N. J., extruded zinc anodes, either as cylinders for ball-anode containers or in any desired length in elliptical form, bring advantages of improved corrosion characteristics and denser metal structure. They are 99.9 per cent pure, and are available in pure zinc ZX, or combined with aluminum in the ZAX anode. They are claimed neither to polarize excessively, nor to produce sludge in either cyanide or acid zinc solutions. For further information, use Reader Service Card.

E—576. Impregnated Glove—Plasti-glov, a plastic-impregnated glove which is said to have wear-resistant qualities greatly surpassing any rubber-coated glove, is being introduced to the industrial and consumer markets by the American Rubberizing Company, Dept. P., 617 11th Avenue South, Minneapolis, Minn.

Waterproof and snag-proof, the form-fitting glove is heat and flame resistant. It is also claimed superior in tensile and tear strength and in acid and alkali resistance over leather or over natural- or synthetic-rubber gloves now in use. For further information, use Reader Service Card.

E—577. Dipper—Increased safety in handling corrosive liquids is made possible by a new dipper for use with a wide variety of chemicals, according to the manufacturer, Stokes Molded Products,

Inc., Trenton 4, N. J. The Stokolite L-44 dipper, of virgin-rubber-base material, is streamlined for lightness and has an efficient pouring lip and a well reinforced handle. It is made in one- and two-quart sizes. For further information, use Reader Service Card.

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Patented
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A. E. S. News

New Sustaining Members

Three companies have joined the Society as sustaining members to support the research program:

Clinton Supply Company, Inc., Chicago, Ill.

Heywood-Wakefield Company, Gardner, Mass.

R. O. Hull & Company, Inc., Rocky River, Ohio.

Whitfield Chemicals, Detroit, Mich.

Our hearty welcome!

Branch Meeting Speaker

The following addition to the lists of speakers published in the July and August issues have been made by President Neill:

NORTON COMPANY
Technical Service Section (c)
Worchester, Mass.

R. M. LORD, Grinding Engineer
Subject:

Abrasives for Barrel Finishings (a 1-hour discussion of tumbling materials, processes, and their possibilities, illustrated with 2 x 2-inch Kodachrome slides)

Liaison with A. S. T. M. Committee B-8

President W. J. Neill has appointed Mr. B. C. Case, Hanson-Van Winkle-Munning Company, Detroit, Mich., to serve as the Society's liaison member of this committee.

Committee B-8 cooperates closely with A. E. S. Research Committee, incorporating into specifications the findings of the latter.

Boston Convention Underwriters An Apology

Through a regrettable blunder, the list on page 875 of the August issue of PLATING of contributors to the underwriting of the Boston Convention was published before the Finance Committee of the Convention had checked it and omitted 20 of the 109 sponsors. Those omitted are named below.

The omissions from the original list were of course accidental, and the Committee wishes to emphasize that the fact of omission had no connection with either amount or date of contribution.

Adams Engineering Co., Newton, Mass.
Allied Research Products, Inc., Baltimore, Md.
Apothecaries Hall Co., Waterbury, Conn.
William F. Cahill, Providence, R. I.
Chemical Prod. Corp., E. Providence, R. I.
Crane Equipment & Supply Co., Waterbury, Conn.
Divine Brothers Co., Utica, N. Y.
Dixon & Rippel, Inc., Kingston, N. Y.
E. I. duPont de Nemours & Co., Wilmington, Del.
W. Green Electric Co., Inc., New York, N. Y.
Frederick Gumm Chemical Co., Kearny, N. J.
O. G. Kelley & Co., Boston, Mass.
Kocour Co., Chicago, Ill.
Lea Mfg. Co., Waterbury, Conn.
Magnuson Products Corp., Brooklyn, N. Y.
New England Lead Burning Co., North Woburn, Mass.
Pennsylvania Salt Mfg. Co., Philadelphia, Pa.
Standard Steel Spring Co., Cornopolis, Pa.
Technic, Inc., Providence, R. I.
Wagner Brothers, Inc., Detroit, Mich.

Paper Awards Committee

President Neill has appointed the following to serve on the Paper Awards Committee for the year 1950-1951:

Henry Strow, Chairman, Waterbury Branch.

Leonard Chesworth, Boston Branch

Milton Nadel, New York Branch

Back Issues of The Monthly Review

Mr. E. L. Beightol, Sr., has kindly contributed a collection of back issues of THE MONTHLY REVIEW to the drive for copies for Branch libraries.

Those who have back copies of THE MONTHLY REVIEW for 1943 or earlier or of the *Proceedings* for 1944 or 1942 or earlier, and who wish to donate them to the Society, should contact the Executive Secretary, P. O. Box 168, Jenkintown, Pa.

Mail Box

(Continued from page 1033)

nonporosity". Isn't that a new view?

In my own name and on behalf of my associates, I appreciate very highly both the criticism and the compliments of our colleagues. May I conclude with a warm handshake across the ocean. N. THON
Project Director A.E.S. Research Proj. No. 6

THERE IS NO SUBSTITUTE FOR *Experience*

DETROIT
GREASELESS COMPOUND
The perfection of this product is the direct result of more than 25 years of experience gained in manufacturing many millions of pounds of polishing compounds and other quality-controlled abrasive materials for the production lines of the Automotive Industry and its many suppliers in the field of Metal Finishing. We sincerely believe it to be the best product for the purpose on the market today.
C. H. McALEER, President.

WE KNOW A TEST WILL PROVE

INCREASED PRODUCTION—Scientific "know-how" of the blending of abrasive grains and binders and proper selection of the compound suited for the job gives you the most uniform finish and increases speed of production.

ECONOMY IN USE—The improved and more durable binder gives ideal adhesion to the wheel; drying time and less "off the wheel" wastage.

IMPROVED CONTAINER—Our aluminum-foil container is almost impervious to moisture-loss and when properly stored will remain in good condition for a year.

LABORATORY CONTROL—Constant laboratory control of all raw materials used and experienced supervision of manufacturing processes is maintained at all times.

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A. E. S. Los Angeles Convention • June 25-28, 1951

The American Electroplaters' Society will at last take a step long awaited by many of its members—hold its convention in that most romantic of cities, Los Angeles.

Convention Committee

A capable and enthusiastic committee is now actively at work to make the Los Angeles Convention a success. It consists of the following:

General Chairman—D. M. Bedwell
General Co-Chairman—R. J. Wooley
Educational—M. H. Orbaugh
Finance—Howard Woodward
Registration—P. V. Rogers
Hotel Reservations—H. J. Kroesche
Program—G. S. Krentel
Entertainment—G. D. McDonald, Jr.
Publicity—G. M. Kent
Banquet—J. D. Millhorn
Luncheon—F. J. Bunker
Outing—G. Brigantino
Exhibit—Kasmer Tarczynski
Plant Visitations—D. D. Williams
Sightseeing—Earl Coffin
Ladies—Mrs. Earl Coffin

Transportation

Complete information about transportation, including coach and first-class pullman schedules and return rates, will be published in the November issue, as well as air schedules and rates. It will also be mailed to members.

Papers

Offer forms for papers are avilable from the Society's headquarters, Box 168, Jenkintown, Pa.

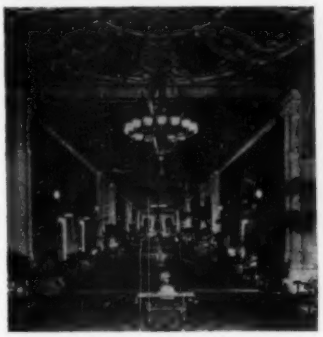
Deadline for papers is January 15, 1951.

The Convention Hotel

Headquarters, the Biltmore Hotel, is said to be the largest and finest in the West. With its 1500 rooms, each with private bath, its four restaurants, its eighteen public rooms wired for public-address systems, and its 1500 employees, the Biltmore is the outstanding convention hotel in Los Angeles, capable of accommodating as many as 2,500 registrants.

In it is the Biltmore Bowl, which for many years was the scene of the glamorous Awards Banquet of the Academy of Motion Picture Arts and Sciences, at which "Oscars" are presented. Other dining rooms include the grille, the coffee shop, and the afternoon "night" club, the Rendezvous.

One of the sights of the hotel is the Galeria Real, the almost city-block long Peacock Alley of the West, with its beautiful tapestries, paintings, and rare art objects.



The Biltmore is the down-town terminal of the airline limousine service, and railroad, steamship, and airline offices are located in the same block.

Motorists may park within 200 yards of the hotel or drive to the Ramp Entrance where the doorman will store the car in the hotel's fireproof garage.

Hotel Reservations

Full information on hotel reservations will be mailed to A. E. S. members and published in Plating.

Eating Places

After a day of technical sessions or other educational features, the convention visitor often wishes to relax at a good dinner. Los Angeles offers the discriminating eater many opportunities to indulge his palate.

Here follow some of the places in and around Los Angeles—some plain, some fancy, all with good food—that are not found in our copy of Duncan Hines' "Adventures in Good Eating".

American

Bel-Air Farmhouse, 666 N. Sepulveda Boulevard, W. Los Angeles. Roast beef, steaks. Simple. Reasonable.

Eaton's Studio City, 12010 Ventura Boulevard, Studio City. Roasts, steaks, chops, seafood, chicken. Modernistic. Studio hangout. Reasonable.

Farmer Johns, 630 N. Sepulveda Boulevard, W. Los Angeles. Steaks, chops, seafood, chicken. Pseudo-rustic. Reasonable.

The Hi-burger, 6001 Vineland, N. Hollywood. Steaks, chops, chili, shrimps. Rare and ancient clocks. Inexpensive.

Jerry's Broiler and Oyster Bar, 729 S. Hill Street. Seafood, steaks, chops. Inexpensive.

Manhattan Supper Club, 4527 S. Western Avenue. Steaks, seafood bar, hors d'oeuvre bar, salad bar. Entertainment. Reasonable.

Old Virginia, 119 Pasadena Avenue, S. Pasadena. Steaks, chops, ham steaks, chicken, seafood. Semicolonial. Reasonable.

Original Pantry, 915 W. 9th Street. Steaks! Chops! "Joint". Inexpensive.

Silver Broiler, 11138 Ventura Boulevard, N. Hollywood. Hickory-smoked hamburgers and hotdogs, steaks, chicken. Inexpensive.

Far Eastern

Travelers' Cafe, 808 W. Temple Street. Philippine (Polynesian-Semichinese) cooking. Simple. Inexpensive.

Vagabond House, 2505 Wilshire Boulevard. Curries, Americanized foods. Fancy. Reasonable.

French

Bel-Air Hotel, 701 Stone Canyon, W. Los Angeles. High continental. Expensive.

Cafe de Paris, 7038 Sunset Boulevard. Home cooking, pastries. Reasonable.

Deauville, 9039 Sunset Boulevard. Top flight. Entertainment. Reasonable.

Felix Young's, 8572 Sunset Boulevard, Hollywood. Everything recondite, chic, rare and expensive. Plush. Entertainment. Reasonable, considering.

Jay's Champagne Room 8588 Sunset Boulevard. Orchidaceous menu. Thickest plush. Expensive.

Scandinavian

Bellman's, 5662 W. Pico Boulevard. Smorgasbord, mixed grill! Unpretentious. Inexpensive.

(*Continued on page 1092*)

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GES

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Branch News

ADELAIDE BRANCH

The general meeting held at the University of Adelaide on August 9 took the form of a debate about "Bright Nickel *vs* Dull Nickel" and "Hot Glue *vs* Cold Cement". According to the President's instruction the members debated the subjects as teams and not from a personal view. It was surprising to see strong bright-nickel advocates hotly defending dull nickel and hot-glue users speaking in favor of cold cement. Each member was allotted approximately five minutes and most took full advantage of the time. It was generally agreed that similar debates should be organized next year, because it gives the practical man, the man that actually does the plating in the shop, an opportunity to air his views.

W. Fisher,
Hon. Secretary

BRIDGEPORT BRANCH

The regular monthly meeting on June 2 was attended by thirty-one members and guests.

William Ehrencrona, Chairman, gave a detailed report of the very successful Banquet and Entertainment held at the Fairfield Inn, Saturday, May 27, in Fairfield, Conn. A letter was received from George Morrow thanking the members for electing him an Honorary Member of the Branch. One member was suspended for nonpayment of dues.

Mr. Philo Balin of the Columbia Records Company, Bridgeport, Conn., a member of the Branch, gave a detailed account of the manufacture of record stampers for the production of phonograph records: The original record is treated, and this "lacquered master" is silver sprayed, nickel plated with very-low-stress nickel to a thickness 0.0005 inch, and copper plated for 18 hours to thickness of 0.030 inch. After separation, the electroformed negative is treated with dichromate solution, nickel plated to a thickness of 0.0005 inch, and copper plated to 0.030 inch. The newly formed positive is separated from the negative and becomes a stamper. After chromium plating it is ready for the production of plastic records. A stamper can produce 2,000 records or more if properly made. Considerable discussion followed the fine talk and demonstration.

Joseph G. Sterling,
Secretary-Treasurer

DETROIT BRANCH

More than 500 members and friends attended the annual "Stag Day" at the

Courtesy O. Henry Tiedeman, Wagner Bros., Inc.

Forest Lake Country Club, near Pontiac, Mich., on July 29. Among out-of-town guests was A. E. S. President W. J. Neill of Columbus Metal Products, Inc., Columbus, Ohio.

It was a perfect mid-summer day, and everyone enjoyed the many activities. Highly popular, because of the heat, was the liquid dispensary.

Every person attending the gathering of the clan received a prize. The Branch wishes to express its sincere appreciation to the many firms which so generously donated the many valuable prizes.

E. A. Steegar,
Publicity Chairman

MELBOURNE BRANCH

Twenty-eight members and visitors attended the 55th regular meeting in the Melbourne Technical College on August 17.

Bob Taylor, on behalf of the Branch, welcomed John Dale back to Melbourne after his trip to America. Mr. Dale made a short reply, at the conclusion of which he presented the fifty-dollar membership prize which had been won by the Branch.

The evening took the form of an open discussion on "Plating to Specification". It was opened by Mr. Ian Miller of the Australian Standards Association with a short talk on the work of his Association, supplemented by a display of literature. Ten other speakers contributed to the discussion, during which design engineers were attacked for their lack of thought in design. This caused a design engineer, who was present, to say a few words in defense. "Is it right," he asked, "for advances in design to be halted because some plater finds a new job difficult to plate with the solutions available?" Subsequent discussion emphasized that the designer and plater must cooperate, particularly in the design stages.

Among comments and suggestions offered was one that the Standards Association should draw up specifications for zinc and cadmium plating.

Rowland H. Keller,
Assistant Secretary

ROCHESTER BRANCH

The regular monthly meeting held on May 26 at the Rochester Turner's Club was preceded by a fish fry, served with the compliments of the local suppliers. Their very efficient committee was headed by Verne Schaeffer. Many thanks go to all the salesmen who contributed.

At the business meeting, the Delegates were instructed to support Dr. Swift of the Boston Branch for the office of Third Vice-President. For 1953 Convention city, the first choice was Buffalo, N. Y.; the second, Philadelphia, Pa. The Delegates were to get all the facts regarding the proposal for financing regional meetings and vote in accordance with their personal experience.

The following were elected to serve during the year 1950–1951:

President—John Dupord

First Vice-President—Gordon W. MacDonald

Second Vice-President—Raymond Berghold

Secretary—Walter Swanton

Treasurer—John Lenzi

Librarian—John Adams

Board of Managers—Robert Flint, William Howard, Joseph Hull, Elmer Nill, William Treadwell

Gordon W. MacDonald,
First Vice-President

CHICAGO BRANCH

Vincent Mattacotti (right), Manager of Milwaukee Plating Company, Milwaukee, Wis., was the featured speaker at the "Metal Conservation" meeting on August 25. With him are (from the left) Librarian J. M. Andrus, Secretary-Treasurer Paul Glab, and President Dr. J. H. Monaweck. The members and guests from Chicago Electroplaters' Institute also heard a chalk talk by Mr. L. J. George, Chicago Manager, The Udylite Corporation

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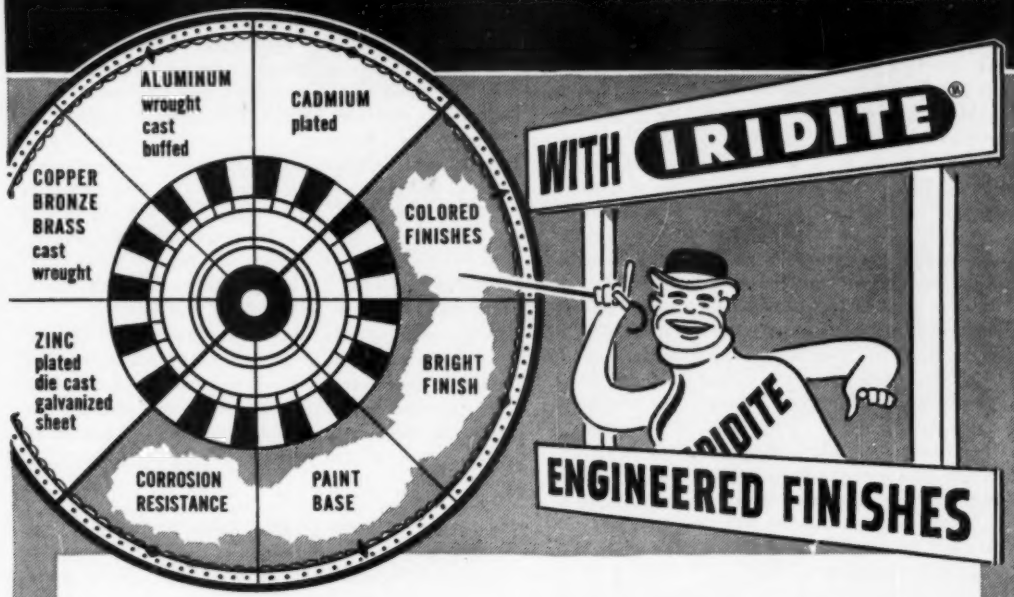

Spin the wheel for any type of chemical finish on non-ferrous surfaces . . . plated, die cast, galvanized, or sheet . . . and there's an Iridite to provide corrosion resistance, a base for paint or to produce an attractive, eye-appealing finish in a variety of colors.

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WE YEARN TO LEARN Say A.E.S. Wives

THE LADIES EDUCATIONAL SESSION at the Boston Convention is one which will be long remembered, directly by the ladies and indirectly by the men.

For the first time, the ladies were privileged to participate in a plating session which helped them to understand better the technical side of plating; therefore, their benefits were direct. The men will benefit indirectly, because their wives will be able to converse more intelligently about plating and its techniques.

The Ladies Educational Session was also excellent from a psychological point of view. It made the ladies feel that they play an important part in the Convention and are not a parasitic element. The Convention Committee had recognized that women want to learn, as well as play, when they are given an opportunity to do so. A "balanced" program, which includes tours, luncheons, etc., on one hand and technical sessions on the other, is ideal.

When the women discussed the Convention and its opportunities, they agreed unanimously that in practice women cannot be divorced from their husbands' work. Many men bring work home with them and discuss its pros and cons with their wives and then expect the wives to talk, as well as to listen.

The general feeling seemed to be that there should be at least one joint session for men and women. Perhaps the opening session can be planned in such a way that some speakers (possibly including one woman) discuss subjects of general interest. Women should receive a special invitation to this session, so that at least the majority would attend. A full explanation might be given during this session of what the men and women might expect to derive from the particular convention. This would give the women a feeling of belonging to the technical program, which is so thoroughly planned each year for the men.

The joint meeting could then branch off into women's and men's technical sessions, for who has more opportunities to examine, criticize, and use plated materials than does the woman? In the final analysis, she is the critic of hundreds of plated articles. The man "plans and creates," the woman "executes" and demonstrates all his efforts.

As pointed out in Boston, the woman comes in contact with plated articles during her entire day. The bathroom contains the door handle, the towel rack, the lipstick case, the comb case, the cosmetic-bottle metal top, the metal around the shower door, and other items. The kitchen is equipped with the toaster, the coffee pot, parts of the stove, cupboard handles, silverware and silver dishes; in fact, a large part of what she uses is plated, partially or in its entirety. When she is dressing for the evening her jewelry is an important item to consider, as well as is her automobile in which she rides.

The plating demonstration in Boston was excellent! It was greeted with much enthusiasm. The general opinion was that we learned a great deal about gold plating, but the session was not long enough. We would have liked to continue with more practical applications during the afternoon. I think many women were sufficiently "educated" in the morning to want additional education in the afternoon. The word spread so quickly that women remarked, "I'm sorry I missed that meeting." Anyway, the women that attended the meeting were able to discuss the demonstration intelligently with their husbands, using words like solution, electrodeposition, anodes, buffing, and others.

We were delighted to learn something about how jewelry is plated, the cost of plating, and how stones and designs are inserted. Groups of women discussed that particular session the following afternoon and the following days, and they are hoping that a "balanced" program for women will be included in the coming convention.

I hesitate to differentiate between educational and social sessions or tours. All have a definite educational value. Perhaps that is why we would welcome a "balanced" educational program, one which would include technical sessions, social activities, and historical tours.

"Many thanks," say the ladies, "to all who were instrumental in launching this first technical session. We are looking forward to something similar in California."

FRANCES M. (MRS. AUGUST) HOFFMAN
Cleveland, Ohio

Mr. George Hogaboom tells a story from the Boston Convention which shows how successful it was with the ladies. Two couples who had made the rounds of the cocktail parties joined Mr. Hogaboom in the lobby of the hotel. One of the ladies, after recounting the good time she had and showing the gold pencil received at the Diggin-Strow educational session, exclaimed, "This is the most wonderful Society. Look how magnificently they do things for the ladies and nothing for the men!"

Those ladies who went on the Tour and Tea at Wayside Inn under the auspices of the M. E. Baker Company, or to The International Fellowship Club's Open House or its Plato Party run by Joan Trumbour Wiarda, or to Aunt Ella's Society Party sponsored by Oakite Products, Inc., at which David Clarin was the moving spirit, or to any of the affairs organized by the Convention Committee under Ann Baker Love, certainly had many opportunities for fun and good fellowship. The Society is proud of the many testimonies received to this effect and grateful to those who made it possible.

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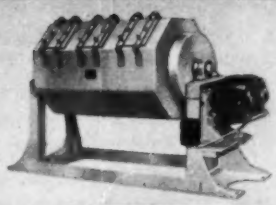

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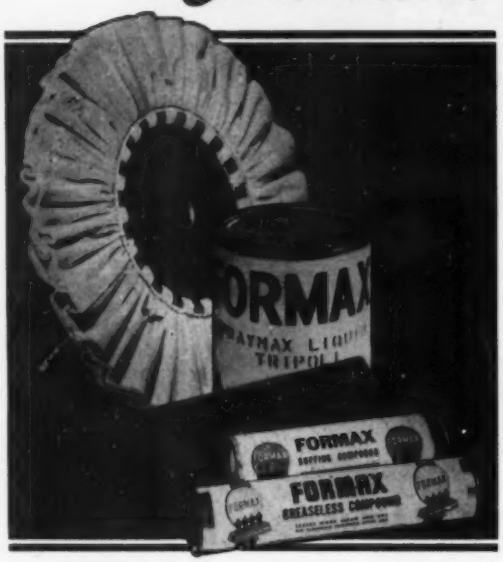

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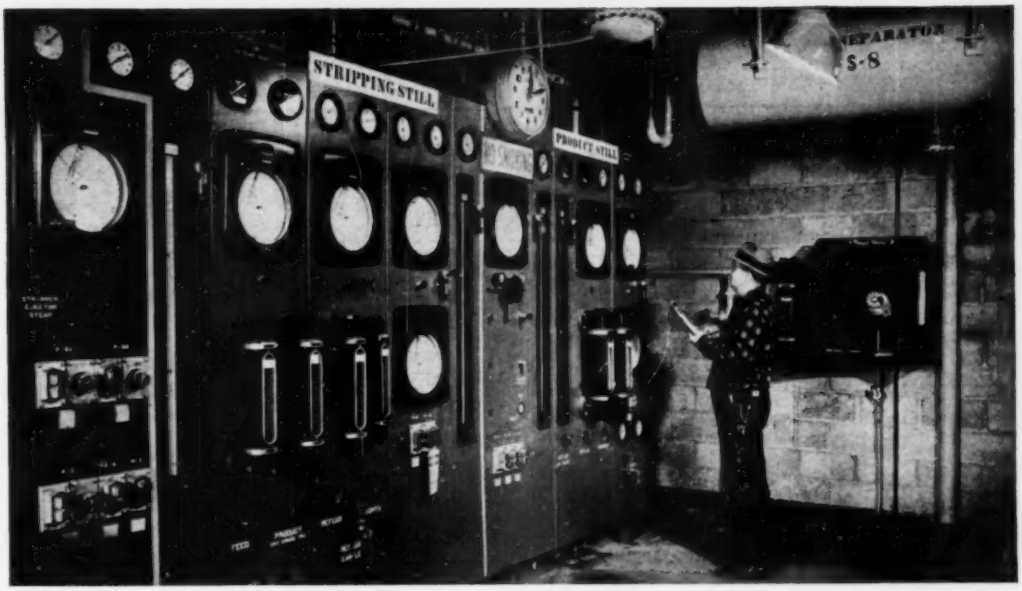

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Membership Report of the A. E. S.

Elections

BALTIMORE - WASHINGTON BRANCH: Dwight E. Couch
BOSTON BRANCH: Monroe S. Glick, Frederic Koury, Karl E. Weiss, Herbert J. Wenham, Robert F. West
HARTFORD BRANCH: Stuart R. Begg,
INDIANAPOLIS BRANCH: Robert M. Worrell
NEWARK BRANCH: Harold Harris
NEW YORK BRANCH: Jack Schwartz, Peter L. Veit
SAN FRANCISCO BRANCH: Herman J. Kramer, John Mackesy
SOUTHEASTERN BRANCH: Joseph S. Linn

Reinstatements

BOSTON BRANCH: Norman J. Houle
HARTFORD BRANCH: G. Giannattasio, John C. McCullough, Edward E. Murphy
INDIANAPOLIS BRANCH: James J. Monagle
MONTREAL BRANCH: Gaston Paquet
ROCHESTER BRANCH: Daniel Taurielo
SYDNEY BRANCH: F. Kulmar, G. Potts, T. Rixon

Transfers

Gilbert Cummins to Baltimore-Washington Branch; Samuel De Jack from Chicago Branch; John K. Werner to Jackson-Lansing Branch; Edison C. Sickman incorrectly published as a transfer to Indianapolis Branch; William H. Armstrong from Newark Branch; Clester W. Smith to Philadelphia Branch

Resignations

BALTIMORE - WASHINGTON BRANCH: D. R. Bonner
HARTFORD BRANCH: Martin H. Drumm, Jr., Charles L. Smith, Julie P. Majkowski
INDIANAPOLIS BRANCH: Harold Lambertus, H. S. Taylor
JACKSON-LANSING BRANCH: G. H. Carter, F. A. Aston
LOUISVILLE BRANCH: Gerhardt Hillebrand, Jr. published in error as a resignation
MELBOURNE BRANCH: J. Fraser, J. W. McOrist, A. E. Trapnell
ROCHESTER BRANCH: Emery McClelland

Suspensions

BOSTON BRANCH: Peter J. Balick, J. C. Burak, A. T. Clarke, J. J. Devlin
HARTFORD BRANCH: Stanley Douda, L. J. Slominski

(Continued on page 1092)

Membership Competition

BRANCH	Membership April 1, 1950*	Net Members	New Change in Membership	Per Cent Net Change
FIRST GROUP				
GRAND RAPIDS	141	6	+17½	+12.4
CLEVELAND	195	18	+15½	+ 7.9
BOSTON	142	12	+11	+ 7.7
DETROIT†	483	23	+20½	+ 4.2
CHICAGO	372	17	+15½	+ 4.2
TORONTO	124	6	+ 3	+ 2.4
NEW YORK	280	5	+ 6	+ 2.1
PITTSBURGH	142	1	+ 1½	+ 1.1
MILWAUKEE	124	2	+ 1	+ 0.8
HARTFORD	132	4	+ ½	+ 0.4
LOS ANGELES	201	7	− 1	− 0.5
BRIDGEPORT	155	4	− 1	− 0.6
NEWARK	238	2	− 2½	− 1.1
PHILADELPHIA	192	4	− 2½	− 1.3
WATERBURY	125	...	− 2	− 1.6
SECOND GROUP				
MONTREAL	68	6	+ 6	+ 8.8
MELBOURNE†	111	9	+ 5	+ 5.0
ROCHESTER	104	4	+ 4	+ 3.8
CINCINNATI	87	3	+ 3½	+ 3.4
BALTIMORE-WASH.	85	3	+	+ 0.6
ST. LOUIS	97	2	.....	.....
NEW HAVEN	106	...	− ½	− 0.5
INDIANAPOLIS	97	4	− 1½	− 1.6
TWIN CITY	71	...	− 3	− 4.0
DAYTON	93	...	− 5½	− 5.9
PROV.-ATTLEBORO.	112	3	− 8	− 7.1
ADELAIDE	72	4	− 6	− 8.3
SYRACUSE	85	5	−11	−12.9
SYDNEY	109	4	−16	−14.7
THIRD GROUP				
ROCKFORD	64	9	+ 9	+14.1
COLUMBUS	47	3	+ 4½	+ 9.6
ST. JOSEPH VALLEY	66	6	+ 6	+ 9.1
ALLENTOWN-READING	37	4	+ 3	+ 8.1
HAMILTON	23	1	+ 1	+ 4.3
SPRINGFIELD	51	1	+ 1	+ 2.0
WESTERN ONTARIO	23	...	.....	.....
SAGINAW VALLEY	64	...	− 2	− 3.1
LANCASTER	62	...	− 6	− 9.7
JACKSON-LANSING	57	...	− 7½	−13.1
SOUTHEASTERN†	54	1	− 8	−14.8
LOUISVILLE	25	...	− 4½	−18.0
SAN FRANCISCO	66	7	−12	−18.2
TOLEDO	49	2	−14	−28.6
OUTSIDE COMPETITION				
AT LARGE	104	17	+17	.....
IN TRANSFER	27	...	− 3	.....
TOTAL A. E. S.	5,236	213	+40	+ 0.8

Active Membership, September 1, 1950.....5,276

*Subject to Correction. †Winners of membership competition in 1949–1950.

SUSTAINING MEMBERSHIP LIST

As of September 1, 1950

(Figures in parenthesis indicate number of memberships held.)

Acme Plating Company, The
Acme Steel Company
Advance Plating Company, The
Alsop Engineering Corporation
Aluminum Company of America
American Buff Company
American Cabinet Hardware Corporation
American Can Company
American Chemical Paint Company
American Hot Dip Galvanizer's Association, Inc.
American Instrument Company
American Nickeloid Company
American Radiator & Standard Sanitary Corporation
American Smelting & Refining Company
American Wire Fabrics Corporation
American Zinc Institute (5)
Apex Plating Company
Apollo Metal Works
Apothecaries Hall Company
Ardco, Incorporated
Armco Steel Corporation
Arrow-Hart & Hegeman Electric Company
Arrow Plating Company, Inc.
Auto City Plating Company
Automotive Rubber Company
Bastian-Blessing Company, The
Belke Manufacturing Company
Bell Telephone Laboratories, Inc.
Bendix Products Division, Bendix Aviation Corporation
Berteau-Lowell Plating Works
Bethlehem Steel Company (2)
Blakeslee, G. S. & Company
Briggs Manufacturing Company
Bruce Products Corporation
Buckingham Products Company (2)
Canadian Hanson & Van Winkle Company, Limited
Casco Products Corporation
Chase Brass & Copper Company
Chemical Corporation, The
Chicago Electro-Platers Institute
Christie Plating Company
Chrome-Rite Company (2)
Chromium Corporation of America
Chromium Process Company, The
Chrysler Corporation (2)
Cinch Manufacturing Corporation
Clayton Mark & Company
Cleveland Graphite Bronze Company, The
Clinton Company, The
Clinton Supply Company, Inc.
Codman, F. L. & J. C., Company
Corona Corporation
Cowles Chemical Company
Crane Company
Croname, Incorporated
Crown City Plating Company
Crown Cork and Seal Company
Crown Rheostat and Supply Company
Darco Corporation
Davies Supply & Manufacturing Company
Daystrom Corporation
Detrex Corporation
Detroit Plating Industries
Diversey Corporation, The
Dixie Electro Plating Company
Doehler-Jarvis Corporation (2)
R. R. Donnelley & Sons Company
E. I. duPont de Nemours & Company
Dura Div., Detroit Harvester Company
Dura-Chrome of Chicago, Inc.
Eastman Kodak Company (2)
Eaton Manufacturing Company
Ekco Products Company
Electric Auto-Lite Company, The (2)
Electrolux Corporation
Ellmore Silver Company, The
Enthone, Inc.
Erie Plating Company
John H. Feeley
Felt & Tarrant Manufacturing Company
Finishing Publications, Inc.
Ford Motor Company (5)
Formax Manufacturing Company
Frigidaire Division, General Motors Corporation
Gemex Company
General Electric Company
General Motors Corporation (5)
Gerity-Michigan Corporation
Gillette Safety Razor Company
Gorham Manufacturing Company
Graham, Crowley & Associates, Inc.
Graham Plating Works
Grand Plating Company
Great Lakes Industries, Inc.
W. Green Electric Company, Inc.
Frederick Gumm Chemical Company
C. Hager & Sons Hinge Manufacturing Company
Hall-Mack Company
Hamilton Watch Company
Hammond Machinery Builders, Inc.
Hanson-Van Winkle-Munning Co. (3)
Harshaw Chemical Company, The (3)
Haviland Products Company
Heil Process Equipment Corporation
Heywood-Wakefield Company
Houdaille-Hershey Corporation (3)
Howard Plating Industries, Inc.
Hub Plating Works
Hudson Motor Car Company
R. O. Hull & Company, Inc.
Hy-Grade Plating Company
Illinois Watch Case Company
Industrial Filter & Pump Manufacturing Company
International Business Machines Corporation
International Nickel Co., Inc., The (5)
International Silver Company
Jones & Laughlin Steel Corporation
Keeler Brass Company
Kelite Products, Inc.
Kelly Plating Company, The
Knape & Vogt Manufacturing Company
Knight-Morley Corporation
Knight Plating Company
Kocour Company
Kohler Company
Kuehne Manufacturing Company
Lasalco, Inc.
Lea Manufacturing Company, The
Lea Manufacturing Company of Canada, Ltd.
Leeds & Northrup Company
Chas. F. L'Hommedieu & Sons Company
Lyon Incorporated
Maas & Waldstein Company
W. D. MacDermid Chemical Company
MacDermid, Incorporated
Magnuson Products Corporation
R. C. Mahoney
Manderscheid Company, The
Matchless Metal Polish Company, The
Mattatuck Manufacturing Company
Maurer Supply Company
McGean Chemical Company, The
Meaker Company, The
Mechanical Plating Company
Mercil Plating Equipment Company
B. Mercil & Sons Plating Company
Metal Finishers, Inc.
Metal Finishing Association of Southern California, Inc.
Metal Mouldings Corporation
Metal Processing Company
Michigan Bumper Corporation
Michigan Chrome & Chemical Company
J. C. Miller Company
Mitchell-Bradford Chemical Co., The
Modern Plating Company
Modern Plating Company, The
Moore Drop Forging Company
Motor Products Corporation
Mutual Chemical Company of America
George L. Nankervis Company
National Aniline Division, Allied Chemical & Dye Corporation
National Brass Company
National Cash Register Company, The
National Lock Company
National Plating Company, Inc., The
National Screw and Manufacturing Company, The
Nelson Chemicals Corporation
New England Buff Company
New England Plating Company
New Jersey Zinc Company (3)
George E. Nichols Plating
G. J. Nickolas & Company
Noblitt-Sparks Industries, Inc.
Northwest Chemical Company (2)
Northwestern Plating Works
Nutmeg Chrome Corporation
Oakite Products, Inc. (2)
Oneida, Ltd.
Packard Motor Car Company
Parker Rust Proof Company
Pennsylvania Salt Manufacturing Company, The

Perma-Line Rubber Products Corporation
Pheoll Manufacturing Company
Philco Corporation
Platers Supply Company
Plating Products Company, The
Price-Pfister Brass Manufacturing Company
Products Finishing
R. C. A. Victor Division, Radio Corporation of America
R. W. Renton & Company
Reynolds-Robson Supply Company (2)
Roberts Rouge Company
G. S. Robins & Company
Roto-Finish Company
Royal Plating and Polishing Company
Sargent & Company
Scientific Control Laboratories
Scovill Manufacturing Company
E. E. Seeley Company, Inc.
Seymour Manufacturing Company, The
J. J. Siefen Company
Standard Plating Rack Company
Standard Plating Works
Standard Steel Spring Company (3)
Stanley Works, The
Frederic B. Stevens, Inc. (2)
Studebaker Corporation, The
George A. Stutz Manufacturing Company
Superior Steel Corporation
Sylvania Electric Products, Inc.
Talon, Inc.
Thomas & Son Company, The
Thomas Steel Company, The
Trico Products Corporation
Turco Products Corporation
Udylite Corporation, The (3)
United-Carr Fastener Corporation
United Chromium, Inc. (2)
United Manufacturing Company
United Platers, Inc.
United States Spring & Bumper Company
Van Der Horst Corporation of America
A. T. Wagner Company
Wagner Brothers, Incorporated
Wald Manufacturing Company
R. Wallace & Sons Manufacturing Company
Walton & Lonsbury
Warner Electric Company
Waterbury Plating Company
Weirton Steel Company
W. W. Wells, Limited
Western Electric Company
Western Rustproof Company
Westinghouse Electric Corporation
Wheeler Industries, Inc.
Whitfield Chemicals
Winchester Repeating Arms Company
Winters & Crampton Corporation
Wollensak Optical Company
Worcester Brass Electro Plating Company
Wyandotte Chemicals Corporation
Yankee Metal Products Corporation

Membership Report

(*Continued from page 1092*)

JACKSON-LANSING BRANCH: G. Banister, R. P. Blake, H. C. Craig, H. A. Talbert, F. W. Worgul

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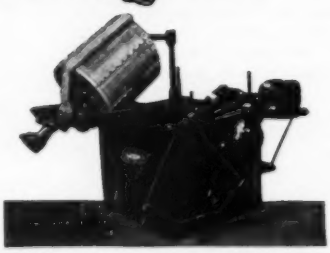

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Phosphatizing, Rust Proofing and Paint Bonding Chemicals

SPECIFICATION NUMBER	ACP SPECIFICATION CHEMICAL
QQ-P-416	"Lithoform"
	"Zinodine"
RR-C-82	"Lithoform" No. 32
MIL-C-5541 (See also QPL-5541-1)	"Alodine"
MIL-S-5002	"Alodine"
	"Granodine" (Dip, Spray and Brush grades)
JAN-C-490, Grade I	"Granodine" (Dip, Spray and Brush grades)
JAN-F-495	"Granodine" (Dip, Spray and Brush grades)
	"Lithoform"
JAN-L-548	"Permadine"
AN-E-19	"Alodine"
	"Zinodine"
AN-F-20	"Alodine"
	"Granodine" (Dip, Spray and Brush grades)
	"Lithoform"
	"Permadine"
	"Thermoil-Granodine"
	"Zinodine"
	(See also U.S.A. 3-213)
U.S.A. 57-0-2	
Type II, Class A	"Thermoil-Granodine"
Type II, Class B	"Permadine"
Type II, Class C	"Granodine" (Dip, Spray and Brush grades)
U.S.A. 51-70-1	
Finish 22.02, Class A	"Thermoil-Granodine"
Finish 22.02, Class B	"Permadine"
Finish 22.02, Class C	"Granodine" (Dip, Spray and Brush grades)
U.S.A. 50-60-1	"Granodine" (Dip, Spray and Brush grades)
U.S. Navord O.S.675	"Alodine"
U.S.N. Appendix 6	"Lithoform"
Navy Aeronautical M-364	"Permadine"
	"Thermoil-Granodine"
AN-C-170	(See MIL-C-5541)
U.S.A. 72-53	(See AN-F-20)
AXS-1245	(See JAN-C-490)

Rust Removing and Metal Conditioning Chemicals

SPECIFICATION NUMBER	ACP SPECIFICATION CHEMICAL
JAN-C-490, Grade II	
Type 4	"Deoxidine" Nos. 126, 512, 526, 624, 670
Type 5	"Deoxidine" Nos. 170, 171, 670
U.S.A. 3-213	
Type I	"Deoxidine" (Wash-off grades)
Type II	"Deoxidine" (Wipe-off grades)

Metal Cleaning Chemicals

SPECIFICATION NUMBER	ACP SPECIFICATION CHEMICAL
JAN-C-490, Grade II	
Type 2	"Ridoline"
Type 6	"Ridosol"
U.S.A. 3-192	"Ridoline" No. 3192
U.S.N. Appendix 6	"Deoxidine"

Acid Inhibitors, Pickling

SPECIFICATION NUMBER	ACP SPECIFICATION CHEMICAL
U.S.N. 51-1-2	"Rodine"

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CINCINNATI meets fourth Wednesday of each month at 8 P. M. in Engineering Society Headquarters, McMillan Street and Woodburn Avenue. Secretary-Treasurer, Charles Wise, c/o The Buckeye Products Company, 7020 Vine Street, Cincinnati 16, Ohio.

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plating

October 1, 1950

Dear Reader:

The one thing in life that we used to take for granted was the air we breathe. "Air, at least, is free", we said. But that is not always true.

Just as there is a great deal of activity in waste-solution disposal to keep our waters pure, so there is much being done to prevent plants from spewing dusts and corrosive and noxious gases into the air. Plating plants in crowded areas encounter this problem.

It is the indoor air, however, which proves most costly to the plating plant. A review of advertisements and items in the Equipment & Supplies and Trade Literature sections of PLATING shows that we have to pay for the privilege of breathing good air, free from harmful or obnoxious dusts and fumes. There are blowers and ducts, separators and collectors, and air-replacement facilities including heaters and air filters, which serve to keep whole departments or buildings free from contamination. Then there are personal protective devices, mainly gas masks with filters or fresh-air supply. Finally there are analytical means for determining atmospheric dust counts and concentrations of gases and fumes.

The variety of items required in many plating plants is truly amazing. Not only does their number increase daily, but they are continually being improved for greater efficiency and comfort.

PLATING brings you news of these developments, whether major or minor.

Sincerely,

Gustaf Soderberg

Future Meetings

COMMITTEE B-8 ON ELECTRODEPOSITED METALLIC COATINGS, A. S. T. M. in Hotel Statler, Buffalo, N. Y. Working Sections, October 9, P. M., and October 10, A. M.; Subcommittees October 10, P. M., and October 11, A. M.; Main Committee, October 11, P. M.

THE ELECTROCHEMICAL SOCIETY 98th Meeting in Hotel Statler, Buffalo, N. Y., on October 11–14.

THIRTY-EIGHTH NATIONAL SAFETY CONGRESS AND EXPOSITION OF THE NATIONAL SAFETY COUNCIL, Chicago, Ill., on October 16–20.

NATIONAL METAL CONGRESS AND EXPOSITION, American Society for Metals, in International Amphitheatre, Chicago, Ill., on October 23–27.

FOURTEENTH ANNUAL NATIONAL TIME, MOTION AND MANAGEMENT CLINIC of the Industrial Management Society in Sheraton Hotel, Chicago, Ill., on November 2–3.

SECOND PLANT MAINTENANCE SHOW AND CONFERENCE in the Auditorium, Cleveland, Ohio, on January 15–18, 1951.

AMERICAN ELECTROPLATERS' SOCIETY Annual Convention in Hotel Biltmore, Los Angeles, Calif., on June 25–28, 1951.

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